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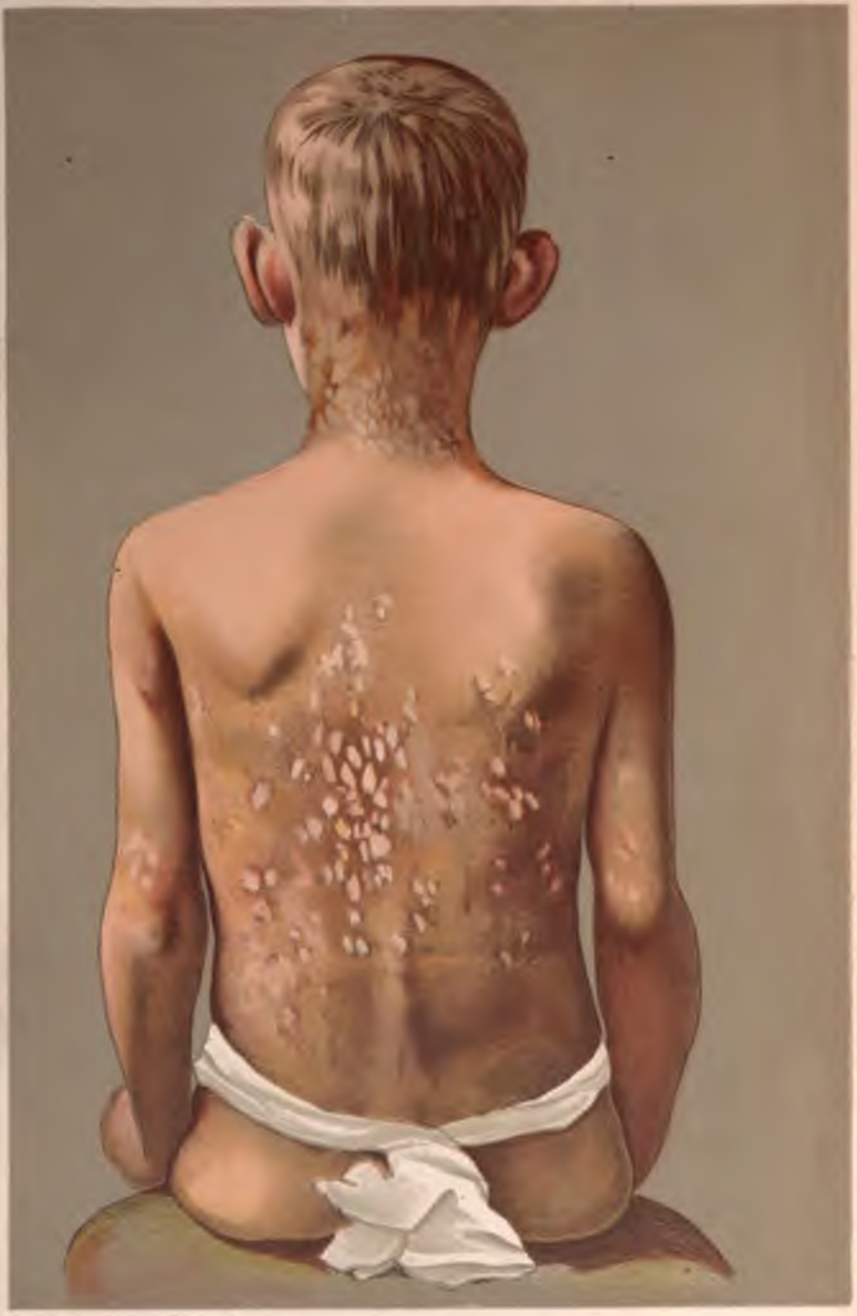

PIGMENTARY SYPHILIDE AND ALOPECIA (Author's case from King's County Hospital). Patient was a female, aged seven years, with acquired Syphilis, and presented a diffuse, wide-spread dark pigmentation over body and neck, with areas of white healthy skin scattered here and there through it. The Alopecia occurred in the form of patches of baldness.

See accompanying note.—MORTON.

GENITO-URINARY DISEASES AND SYPHILIS

BY

HENRY H. MORTON, M.D.

Clinical Professor of Genito-urinary Diseases in the Long Island College Hospital; Genito-urinary Surgeon to the Long Island College and Kings County Hospitals and the Polhemus Memorial Clinic.

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TO THE MEMORY

OF

MY OLD TEACHER AND FRIEND

DR. ALEXANDER J. C. SKENE

IN RECOGNITION OF HIS BRILLIANT ABILITIES AS A SURGEON
AND IN AFFECTIONATE REMEMBRANCE OF HIS
PERSONAL QUALITIES AS A MAN

THIS WORK IS DEDICATED

PREFACE.

IN the past ten years no branch of surgery or medicine has made greater progress than the department of genito-urinary surgery. In that short period of time, the treatment of acute and chronic gonorrhœa has been removed from mere empiricism and placed upon a scientific and rational basis. This has been accomplished through investigations, whose results have given us a definite knowledge of the micro-organisms concerned, and the pathological changes in the urethral tissues which their presence excites.

The whole subject of chronic seminal vesiculitis, with its relation to sexual neurasthenia, and the ever-present danger of lurking infection, has been clearly demonstrated. It is less than ten years since the cystoscope came to be of practical use, and out of its development grew the various instruments for collecting the urine from each kidney separately, in this way stimulating a greater interest in the subject of renal surgery.

While the operations for stone in the bladder are as old as civilization itself, the improvements in the technique of lithotomy, and a clearer comprehension of the indications for each form of operation, are matters of very recent growth. Ten years ago the cases of hypertrophied prostate in old men were without remedy, after the failure of the catheter to alleviate the urgent symptoms, but to-day the operations of prostatectomy, castration, and Bottini's operation have opened a way of relieving the suffering and prolonging life.

The above-mentioned advances are only a few of the steps in the progress of this important branch of surgery.

In this little volume the author has endeavored to present, in a concise form, the present *status* of genito-urinary diseases and syphilis. At the same time he has endeavored to keep in mind the needs of the practitioner, whose opportunities for seeing such cases may be infrequent, and to consider the questions of diagnosis, prognosis, and treatment in such a way that the book may be of practical use in these matters.

40 Schermerhorn Street,
Brooklyn-New York.

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DISEASES OF THE PENIS.

CHAPTER I.

PHIMOSIS.

By the term phimosis is understood an abnormal narrowing of the opening of the prepuce, which prevents the retraction of the foreskin and causes the glans penis to be permanently covered.

Phimosis may be *congenital* or may be *acquired* in adult life.

In nearly all male children at birth the foreskin is long and is adherent to the glans. In early life these adhesions are very weak and are easily ruptured by erections of the penis or manipulation, and in the course of the first few years the preputial orifice becomes enlarged and the prepuce can be stripped back over the glans. If the adhesions are not ruptured early, they become firmer as they grow older, and prevent the complete retraction of the foreskin.

The *acquired* form of phimosis occurs in adults, and often results from the cicatricial contraction of the margin of the prepuce following the healing of a chancroid in this location.

Temporary phimosis often results from the swelling and œdema of the prepuce which occurs in the course of an attack of gonorrhœa or subpreputial chancroids.

As **direct results** of phimosis the following conditions are met with:—

(*a*) *Balanitis and venereal warts,* resulting from the maceration of the epithelium in the balano-preputial sac, from retention of smegma and urine. On account of the difficulty of retracting the prepuce, proper cleanliness cannot be observed, and the tender mucous membrane is especially liable to persistent and recurrent attacks of inflammation. Proliferation of the epithelial cells occurs, and venereal warts grow luxuriantly.

(*b*) *Preputial calculi,* or concretions, form not infrequently, from a calcification of the smegma and the decomposition of the urinary salts.

(*c*) *Epithelioma of the penis* is strongly predisposed to by the continued irritation of the foreskin and retained secretions under it.

(*d*) *Arrested development of the penis* usually occurs in consequence of the malnutrition from which the organ suffers.

(*e*) *Premature erections and sexual excitement* are generally noted in young children affected with phimosis, and the continued irritation about the head of the penis often establishes a habit of *masturbation.*

(*f*) *Interference with the act of coitus*, often accompanied by premature ejaculation, is frequently complained of by adults affected with phimosis.

(*g*) *Liability to infection with syphilis or chancroidal poison* is invariably the case when the prepuce is long, even though it can be retracted, and Hutchinson points out that the circumcised Jew is less liable to contract syphilis than an uncircumcised person, because after circumcision the integument of the glans becomes horny, and not liable to abrasions.

The **remote results** of phimosis are equally important, and often present great difficulties in the exact determination of their origin.

(*a*) *Retention or incontinence of urine*, especially in children, but sometimes in adults, is often caused by a spasmodic contraction of the cut-off muscle or an irritable bladder, induced by the irritation about the glans penis.

(*b*) *Hæmorrhoids, prolapsus ani, hernia, and dilatation of the ureters and kidney pelves* often follow the prolonged and violent straining efforts which individuals affected with phimosis make, upon urinating, in order to overcome the resistance offered by a spasmodic stricture or a pin-point opening through the prepuce. The susceptible nervous system of children renders them particularly liable to the above-mentioned difficulties and also to the following affections:—

(*c*) *Affections of the nervous system,*—spastic palsies, simulated hip-joint disease, muscular inco-ordination, and convulsions,—which are often observed in young children as reflexes from a tight or adherent prepuce, and a disappearance of these symptoms often follows circumcision.

(*d*) *Herpes præputialis* is another manifestation of the reflex action upon the nervous system and skin of the prepuce occasioned by the irritation of a long foreskin, even though it is possible to retract it over the glans.

TREATMENT.

On account of the manifold advantages offered by an absence of the foreskin, it would be well if Christian nations were to adopt the old Hebrew rite of circumcising all male children on the eighth day after birth. In this operation the foreskin is simply snipped off with one sweep of a knife, and the wound washed with a weak astringent antiseptic. The pain is slight, and an anæsthetic is not required, nor would it be safe to administer one in so young a child. Hæmorrhage is trifling, and there is but little risk of infection afterward.

Stripping back the foreskin and breaking up the adhesions is sometimes recommended, but is a very poor makeshift for circumcision, and there is always the danger of the prepuce being caught back behind the glans, and becoming swollen and constricted, causing *paraphimosis.*

Circumcision is the operation of choice, and may be performed in two ways:—

(a) Circumcision with a Clamp.—In this operation the clamp is applied to the foreskin immediately below the glans penis, and all the prepuce which projects beyond the clamp is severed with a knife or scissors. This incision simply cuts through the skin alone, and the mucous membrane lying next the glans is left intact and must next be trimmed off with the scissors. After this is done the cut edges of skin and mucous membrane are stitched together with interrupted sutures of catgut, and the operation is completed.

There are certain objections to this procedure. In applying the clamp, if too much traction is made on the foreskin, the skin of the proximal end retracts close up to the root of the penis after the incision is made, and leaves a gaping raw surface of mucous membrane to be covered. On the other hand, if too much foreskin is left, the glans remains covered by it and the object for which the operation was performed is not accomplished. Even when the incision is properly made the subsequent adjustment of skin and mucous membrane often induces a certain amount of tension and dragging upon the sutures, which interferes with the healing of the wound. For these reasons the author prefers the operation of

(b) Circumcision by Dorsal Incision and Trimming off the Flaps.—The surgeon stands upon the patient's left side and with a pair of straight scissors makes an incision on the dorsum of the prepuce, cutting through skin and mucous membrane at the same time. The incision is carried up to the point where the mucous membrane is reflected upon the glans penis. A grooved director may be introduced under the foreskin if desired, to act as a guide for the scissors.

After the dorsal incision is made the two remaining flaps of skin and mucous membrane are trimmed off with curved scissors. This incision is carried around the penis on both sides, following the line of insertion of the mucous membrane at a distance of one-eighth of an inch from the glans.

The frænum is divided last, and its artery, together with the dorsal artery, and sometimes one or two smaller ones, are picked up and tied, and the sutures are introduced.

It is desirable to place the first suture on the dorsum of the penis, and the second suture stitches the remains of the frænum to the point of skin underneath it. These anchor the skin and prevent it from shifting, as it lies on the mucous membrane. The other sutures are then introduced, and usually three on a side will be found enough. Fine catgut is the best material, as it is absorbed, while if silk sutures are used much trouble is experienced in removing them.

The best form of dressing seems to be a piece of lint wet with an antiseptic solution and changed frequently, as any sort of permanent dressing is soon soaked with urine. The patient should remain quietly in bed or on a lounge, for a week, and may be then allowed to go about as usual.

With regard to the anæsthetic used, the operation may be done painlessly with cocaine, injected hypodermically under the skin of the penis along the line of incision, and in order to anæsthetize the mucous membrane $^1/_2$ drachm should be injected into the balano-preputial sac and held there for five minutes. The œdema of the cellular tissue resulting from tying a rubber bandage around the root of the penis to prevent the too rapid absorption of the cocaine interferes with the best healing of the wound afterward, and on that account the author prefers to administer a general anæsthetic. A better result will be obtained if the patient is kept in bed for a few days following the operation than if allowed to be up and about his room.

BALANO-POSTHITIS.

Balanitis consists in an inflammation of the mucous membrane covering the glans penis, and an inflammation affecting the mucous layer of the prepuce is termed posthitis. The inflammation of both surfaces usually exists simultaneously, and should be considered together.

Balano-posthitis cannot occur in an individual who has been circumcised, but the presence of a long and phimotic foreskin allows the retention of the natural secretion of smegma and a few drops of urine, which decompose and irritate the already macerated mucous membrane, lowering its power of resistance to germ-infection.

Gouty and lithæmic conditions and diabetes also render the patient extremely liable to develop inflammation of the mucous membrane underneath a long foreskin.

As a direct exciting cause it is probably necessary that micro-organisms of some sort must be inoculated, and for this reason a balano-posthitis often develops from contact with irritating vaginal secretions in coitus or the accidental introduction of pyogenic organisms from contact with the hands or clothing.

Chancre, gonorrhœa, and chancroid are apt to be complicated by balano-posthitis as a result of mixed infection, when they occur in an individual having a long foreskin.

SYMPTOMS AND COURSE.

A mild form of balano-posthitis is liable to occur at frequent intervals unless the man with a long foreskin attends with scrupulous care to drawing it back and washing it, and the preputial sac, at frequent intervals.

If this is not done, a sense of heat and itching is noticed at the end of the penis; the mucous membrane becomes hyperæmic, infiltrated, and eroded; and a creamy-yellow, purulent discharge, with an extremely offensive odor, is secreted from the mucous membrane of the preputial sac.

In *severe* cases the excoriations are extensive and well marked and the inflammation and œdema are extreme; so that the whole prepuce becomes swollen. In this condition *gangrene* of the foreskin, either in part or as a whole, not infrequently takes place.

DIAGNOSIS.

The diagnosis of balano-posthitis presents but little difficulty, when the foreskin can be retracted and the glans inspected; but when phimosis exists the diagnosis is often perplexing.

If a microscopic examination of the discharge fails to reveal gonococci, but discloses numerous staphylococci, gonorrhœa may be excluded.

Chancroid may be diagnosed by inoculating some of the preputial discharge upon the patient's thigh, and, if other chancroids are caused, it is probable that the original sore was a chancroid, although it is possible to cause sores resembling chancroids by the inoculation of staphylococci.

Chancre can be excluded by the absence of an indurated mass under the prepuce and the lack of the characteristic enlargement in the inguinal glands.

Epithelioma is often difficult to differentiate from the chronic form of balano-posthitis which affects middle-aged men; but epithelioma does not respond to local treatment, while balanitis improves quickly. In cases of doubt it is always in order to excise a small portion of the prepuce and subject it to microscopic examination to determine the question.

TREATMENT.

The essential points in the treatment are to keep the *parts clean and dry.* These indications can be met in the following manner:—

In the cases when the *prepuce can be retracted,* the balano-preputial sac should be washed out with a mild antiseptic solution, either bichloride (1 in 10,000 to 1 in 4000) or Thiersch's fluid. The parts should then be dried and covered with a dusting-powder:—

℞ Pulv. amyli.	
Pulv. zinci oxidi.	
Pulv. talci	aa ʒij.

Or:—

℞ Hydrarg. chlor. mite	gr. xxx.
Acidi borici	gr. xv.
Acidi salicylici	gr. v.

In chronic cases, occurring in elderly men, subgallate of bismuth has a particularly good effect.

After applying the dusting-powder the glans should be covered with a layer of cotton and the foreskin drawn forward into place. This dressing should be changed several times a day.

If the erosions are deep and extensive, their healing can be hastened by brushing them over with a 10-per-cent. nitrate-of-silver solution before applying the dusting-powder.

When *phimosis* exists and the *foreskin cannot be retracted*, a long, flat-billed syringe should be used for washing out the balano-preputial sac, every few hours.

A few syringefuls of warm water and soap may be thrown in and followed by injecting bichloride solution (1 in 10,000) or Thiersch's fluid.

The œdema and swelling of the parts may be mitigated by prolonged soaking in hot water.

If the balanitis occurs as a result of diabetes or a subpreputial chancroid, it may be necessary to relieve the tension by slitting up the prepuce on the dorsum in order to avert impending gangrene.

In all cases of chronic or relapsing balano-posthitis, in addition to local measures, attention should be directed to the diathetic conditions which prevent a permanent healing. If the individual is gouty or diabetic, a suitable regimen should be adopted, and the general health carefully looked after.

In obstinate cases of balano-posthitis, circumcision should be performed as soon as the acute symptoms have subsided. This is especially necessary in elderly men, who are at an age when epithelioma is liable to develop on the glans or under the prepuce from the prolonged irritation of the parts.

In diabetic patients the operation of circumcision should be avoided if possible and the danger of extensive gangrene following slight operations should be borne in mind. If any operative procedure is demanded, it is of the highest importance to get the patient's urine in good condition before operating.

HERPES PROGENITALIS.

This affection is characterized by the formation of groups of small vesicles upon an erythematous base and located on the skin or mucous surface of the prepuce.

The thin vesicles are easily ruptured, and leave small, round, shallow, punched-out ulcers, which heal spontaneously in a few days.

Unlike herpes zoster, herpes progenitalis is generally unaccompanied with pain. In exceptional cases, however, pain is felt, which is neuralgic in character and precedes the appearance of the eruption.

A urethral discharge is sometimes observed, and endoscopic examination shows a collection of vesicles located *within* the urethra.

Recurrence is a marked characteristic of herpes progenitalis, and it is the rule for patients to have several attacks a year.

ETIOLOGY.

Herpes progenitalis may be regarded as a reflex manifestation of some irritation of the nerves supplying the genitals, and is usually due to balano-posthitis, excessive coitus, or a long prepuce. Gouty and lithæmic conditions are thought to predispose the patient to attacks of herpes.

DIAGNOSIS.

If the case is seen early, the appearance of the vesicles is unmistakable, and after they have ruptured the small, round, punched-out ulcers are quite characteristic.

The lymphatic glands in the groin are usually not affected, but in one case in ten the inguinal glands are said to be enlarged in a chain, as in syphilis. (J. W. White.)

TREATMENT.

The herpetic lesions rapidly heal with cleanliness and the application of a simple absorbent dusting-powder. Recurrent herpes progenitalis, which almost always occurs in connection with a long foreskin, can only be prevented by the operation of circumcision.

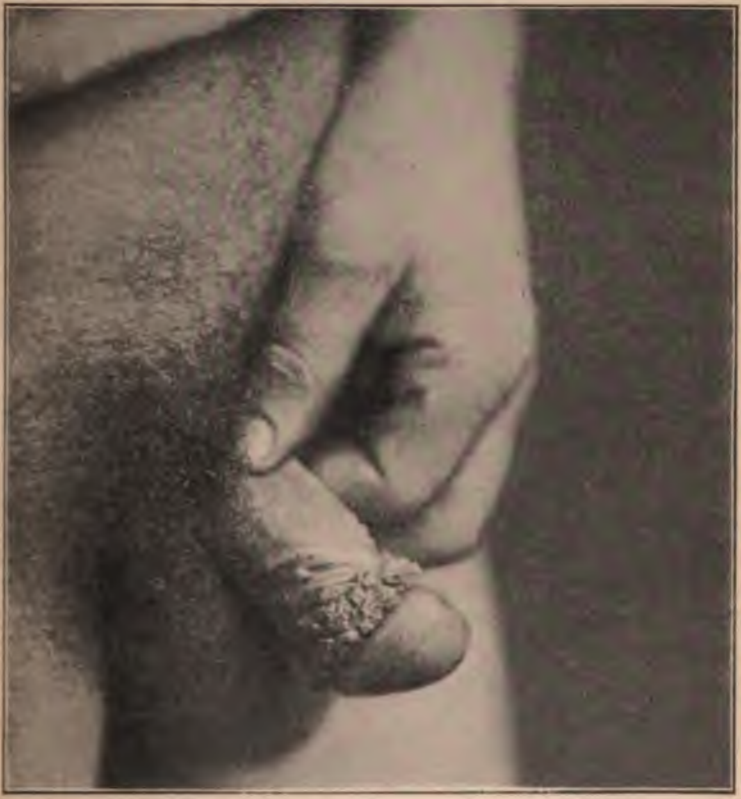


Fig. 1.—Papillomata—Venereal Warts. (Author's Case, from Kings County Hospital.)

PAPILLOMATA.

Papillomata occurring about the head of the penis are frequently termed *venereal warts.* They are sometimes spoken of as *condylomata,* which is manifestly incorrect, as true condylomata are a manifestation of syphilis, and the papillomata have no connection with syphilis, but are of purely local origin.

Papillomata consist in warty growths, which are flat or often cauliflower-like excrescences, usually located in the coronary sulcus under a long prepuce. In structure they are a simple hypertrophy of the papillary layer, and are caused by the prolonged maceration and softening of the mucous surfaces under a long foreskin, occasioned by contact with irritating discharges from gonorrhœa, chancroids, or balano-posthitis.

DIAGNOSIS.

Papillomata may be mistaken for the condylomata of syphilis or epithelioma. In syphilitic condylomata, however, other signs of specific disease are always present; but epithelioma may be difficult to differentiate from simple papillomata, and every warty growth occurring about the glans penis in elderly men should be regarded with suspicion.

TREATMENT.

Small warts sometimes disappear if the parts are kept clean and covered with a dusting-powder; but their disappearance is a matter of uncertainty, and always very slow. Operation is the best treatment, and should always be advised.

As papillomata occur in consequence of a long foreskin, circumcision should be performed, and the warts which are not removed with the prepuce scraped off with a sharp curette. In order to prevent a recurrence, it is desirable to cauterize the bases with nitric or carbolic acid or the Paquelin cautery.

CANCER OF THE PENIS.

Malignant disease of the penis occurs almost invariably as epithelial carcinoma, and begins with about equal frequency on the inner surface of the prepuce or upon the glans.

According to Jacobson, its mode of commencement is varied, but it appears most frequently as: (*a*) *A wart*, or *warty excrescence*. Sometimes, however, it makes its appearance as: (*b*) *A small nodule*, or *knot of induration*, under the surface of the mucous membrane.

Again, epithelioma is observed occurring under the form of (*c*) *a superficial excoriation*, or *raw patch*, resembling the erosions found in balano-posthitis; or it may develop as (*d*) *an ulcer* resulting from the transformation of a chancroid or the breaking down of an old cicatrix, or sometimes from a crack or tear on the margin of a tight foreskin.

In cases of extreme rarity epithelioma of the penis develops from the *extension of the malignant process* outward from the urethra or upward from the scrotum.

ETIOLOGY.

Under the head of predisposing causes *age* plays an important rôle, and epithelioma of the penis is very rarely found except between the fiftieth and seventieth years.

The next most important predisposing cause is *phimosis*. Demarquay found that out of fifty-nine cases of epithelioma of the penis, forty-two had long and phimotic foreskins, and many authors have called attention to the fact that the circumcised Jews are almost entirely free from this disease.

Even though the glans be covered with a long foreskin, if the individual attends to the daily cleansing of the balano-preputial sac there is no opportunity for irritating secretions to be retained; but we notice that cancer of the penis almost always occurs in men in the lower walks of life, of neglectful and uncleanly personal habits.

Any condition which gives rise to a balano-posthitis, such as the retention of decomposed smegma and urine under a phimotic foreskin, particularly if aggravated by a gouty diathesis in the patient, excites a persistent and long-continued irritation. In an elderly person in course of time the simple inflammatory process undergoes a transition into carcinoma of a polymorphous type, composed of large pavement-cells and small epithelial cells.

COURSE.

No matter in what form the disease had its origin, its course is one of extension at the edges, accompanied by ulceration and breaking down in the older parts, and in most cases this is attended by the formation of large vegetations, or fungosities, resembling a cauliflower in shape.

A thin fluid, of a most disgusting odor, which dries into scabs, is continually secreted.

As the cancerous process extends only by continuity, its advance through the corpora cavernosa is not rapid, but the lymphatics readily take up the infectious material, carry it to the glands in the groin, and these are usually involved quite early in the disease.

The inguinal lymphatic glands are often the seat of a mixed infection, if pyogenic bacteria have been conveyed to them through the lymphatics and cause them to become inflamed and suppurate.

DIAGNOSIS.

Every warty or papillomatous growth, or persistent erosion occurring on the glans penis, or inner surface of the prepuce, in an elderly person, should always be regarded with grave suspicion.

It is often difficult to differentiate simple papillomata or a chronic balano-posthitis from carcinoma, but the age of the patient, the long, protracted duration of the sore, together with a base which is hard, infiltrated, and immovable, and an edge which is hard and infiltrated, would point strongly in the direction of epithelial carcinoma. The diagnosis could be definitely determined by cutting a small piece from the growth and subjecting it to microscopic examination.

A gumma of the penis occurring in tertiary syphilis might be easily mistaken for epithelioma; but a few weeks' treatment with mercury and iodides would cause the gumma to disappear.

PROGNOSIS.

The prognosis of epithelioma of the penis is, of course, fatal without operation, and death occurs in from one to two years. If the disease is seen early and the growth removed by amputation of the penis and extirpation of the groin glands, the prognosis is good; but many cases come into the hands of the surgeon too late for a complete removal of all the foci of infection. Winiwarter reports 12 amputations, of which 5 remained permanently well, 1 died of the operation, and 6 had recurrences, 3 of which were in the stump and 3 in the glands.

TREATMENT.

As already indicated, complete removal of all deposits at the earliest possible moment offers the patient the only opportunity of saving his life, and the application of caustics only excites greater activity in the growth and is a waste of valuable time.

Two forms of operation are in use, and a selection depends upon the extent to which the inguinal glands and corpora cavernosa are involved.

OPERATIONS.

Amputation of the Free Portion of the Penis.—*Technique.*—A No. 20 French sound is introduced through the meatus into the bladder to indicate the position of the urethra.

A harelip-pin is thrust through both corpora cavernosa, at the root of the penis, to hold in place a rubber band, which is made to encircle the penis and act as a tourniquet.

The skin of the penis is then cut through with a circular sweep of the knife, and turned back an inch. The corpora cavernosa are divided, down to the corpus spongiosum, which, with the urethra, is left to project like a spout for an inch, before being cut through.

The tourniquet is then unloosed and at least four arteries will require ligation. The skin-flaps are sutured together, and the urethra stitched to the margins of the skin-flaps.

A soft-rubber catheter is tied in the bladder to prevent the urine from infecting the fresh wound.

Amputation of the Entire Penis.—This is a much more serious operation than the former, but is demanded in the case of extensive infiltration of the corpora cavernosa with cancerous deposit.

Technique.—The patient is placed in the lithotomy position, and a sound is introduced through the urethra into the bladder. An incision is made along the raphé of the scrotum, splitting it into two halves. The dissection is carried down so that the corpus spongiosum is seen perforating the triangular ligament, with the corpora cavernosa lying on either side and attached to the rami of the pubes.

The corpus spongiosum, containing the urethra, is then dissected away from the corpora cavernosa for three inches, cut through, and allowed to hang down out of the way, at the lower angle of the wound.

The next step is to separate the corpora cavernosa from their attachments to the rami of the pubes. It is generally recommended that this should be done with a periosteal elevator. The close attachment to the bones renders this a matter of considerable difficulty, and after separation there is a free hæmorrhage, which is difficult to control.

The author prefers to burn through the crura penis with a Paquelin cautery close to their attachments to the bone, and in this way the corpora cavernosa are readily freed from the pubes and without hæmorrhage. The Paquelin can also be used to stop bleeding, which generally occurs from the dorsal vessels of the penis under the symphysis pubis, at the upper angle of the wound.

The final steps of the operation consist in bringing the urethra up into the wound and stitching it to the margins of the skin-flaps, and then the skin on either side is brought into apposition and stitched.

A catheter may be carried through the urethra and left in the bladder to drain it.

In this operation the testicles are exposed and may be left in the wound, or castration may be performed, to quell the sexual desire on the part of the patient after his recovery.

The inguinal lymphatic glands should be removed at the time any operation is performed for the relief of malignant disease of the penis, for if the glands have become infected, which occurs early in the disease, a recurrence of the cancer will inevitably take place later on.

DISEASES OF THE URETHRA AND ITS ADNEXA.

CHAPTER II.

ANATOMY OF THE URETHRA.

THE urethra is a canal, open at both ends, whose walls lie in wrinkled folds and come closely in contact except when distended by the passage of urine or a catheter.

The length of the canal from meatus urinarius to sphincter vesicæ is about eight inches and it is divided into three regions:—

(*a*) The anterior or pendulous urethra, which is six inches in length.

(*b*) The membranous urethra, which is about one inch long.

(*c*) The prostatic, or posterior, urethra, which is one inch in length.

The anterior urethra is surrounded by the erectile tissue of the corpus spongiosum, which terminates in the bulb. At a point corresponding to the bulb, in the anterior urethra, and lying between the peno-scrotal junction and the anterior layer of the subpubic triangular ligament, for a distance of an inch, is a part of the canal which is termed the bulbous urethra.

The membranous urethra is the portion of the canal lying between the anterior and posterior layers of the triangular ligament. Its mucous membrane is not so richly supplied with mucous glands and follicles as the other portions of the urethra, and it acts as a barrier to the onward progress of a gonorrhœal inflammation.

The membranous urethra is surrounded by bands of voluntary muscular fibres known as the **cut-off muscle**, or ***compressor urethræ***, which is normally in a state of tonic contraction, and acts as a valve to separate the anterior from the posterior urethra.

Before the act of urination the cut-off muscle is relaxed in order to allow the urine to flow out past it, and by its voluntary contraction the flow of urine can be instantly shut off.

The cut-off muscle is sometimes affected by a cramp-like contraction and fails to relax, causing retention of urine or rendering

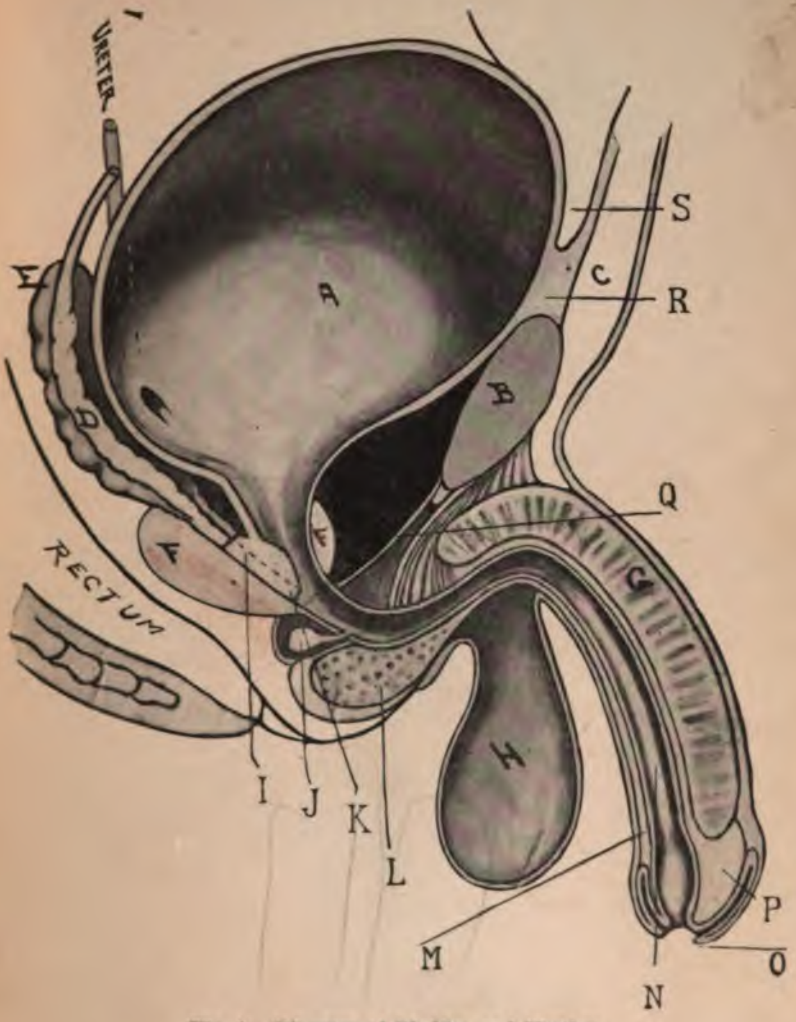


Fig. 2.—Diagram of Bladder and Urethra.

A, Interior of Bladder.
B, Symphysis Pubis.
C, Integument.
D, Vas Deferens.
E, Vesiculæ Seminales.
F, Prostate Gland.
G, Corpus Cavernosum.
H, Scrotum.
I, Verumontanum.
J, Cowper's Gland.
K, Orifice of Ejaculatory Duct.
L, Bulb of Corpus Spongiosum.
M, Corpus Spongiosum.
N, Urethra.
O, Prepuce.
P, Glans Penis.
Q, Suspensory Ligament.
R, Space of Retzius.
S, Peritoneal Fold.

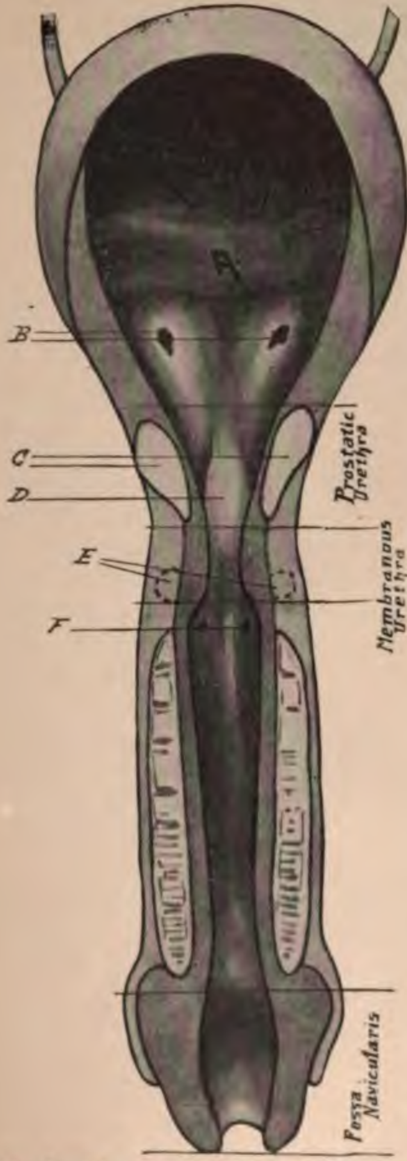


Fig. 3.—Diagram of Bladder and Urethra.

A, **Bladder Base.**
B, **Opening of Ureters.**
C, **Prostate Gland.**
D, Verumontanum.
E, Cowper's Glands.
F, Mouth of Ducts from Cowper's Glands.

it difficult or impossible to pass a sound. This condition is known as spasmodic stricture.

The prostatic, or **posterior, urethra** perforates the prostate gland. It is very richly supplied with mucous glands and follicles. Upon its floor is a small elevation composed of erectile tissue and abundantly supplied with nerves, and called the *verumontanum,* or *caput gallinaginis.* At its base, in front, is a small depression, the sinus pocularis, or uterus masculinus. The ejaculatory ducts and the prostatic sinuses empty into the urethra on either side of it.

The urethra is not like a tube of uniform calibre, but is a canal of varying width and distensibility. There are three points of **physiological narrowing**:—

I. At the meatus.

II. Somewhere in the third inch.

III. The membranous urethra, lying between the anterior and posterior layers of the triangular ligament.

The points of **widening** which are susceptible of instrumental dilatation to a considerable extent are as follow:—

I. The fossa navicularis, which is located just within the meatus, and contains in its roof a large mucous crypt: the lacuna magna.

II. The bulbous urethra, which lies just in front of the triangular ligament and extends for one and one-half inches. It is the widest and most dilatable part of the anterior urethra.

III. The prostatic urethra, usually termed the posterior urethra, is capable of greater distension than any other portion of the urethral canal, and may be dilated to 40 or 45 of the French scale without injury.

The mucous membrane which lines the urethra is soft, delicate, and easily lacerated, and is composed throughout its entire length, excepting the fossa navicularis, of epithelial cells of the *cylindrical* variety. It is richly supplied with glands and follicles.

The glands of Littré lie beneath the mucous membrane in the meshes of the corpus spongiosum and are true glands, lined with secreting epithelium and provided with a duct which empties upon the free surface of the urethral mucous membrane. They are very numerous, and are arranged in groups together.

The follicles of Morgagni are simple crypts or depressions of the urethral mucous membrane, and are located upon the roof of the canal.

CHAPTER III.

ACUTE URETHRITIS.

ACUTE urethritis may be divided into **three varieties:—**

(a) An aseptic catarrh, in which no micro-organisms are present and which is due entirely to chemical irritation.

(b) Simple urethritis, which is occasioned by inoculation of the urethral mucous membrane with pyogenic bacteria (staphylococci or streptococci).

(c) Specific or **gonorrhœal urethritis,** which is produced by the gonococcus of Neisser.

Among the **predisposing causes** to any variety of urethral inflammation may be mentioned a damaged condition of the urethra from previous disease which has left behind granulations, erosions, or a stricture; anatomical abnormalities, such as a long and narrow prepuce, a wide urethral orifice, and hypospadias; certain diathetic states, such as gout, rheumatism, and tuberculosis, which predispose to inflammation by lowering the resisting power of the body to bacterial invasion.

SIMPLE URETHRITIS.

Any of the pus-producing bacteria—*i.e.*, staphylococcus, streptococcus, etc.—will excite a catarrhal inflammation, with suppuration, of the mucous membrane, if introduced into the urethra. The micro-organisms may be introduced from without, through sexual intercourse, and are contained in menstrual discharges, leucorrhœa, secretions from an ulcerated cervix, and utero-vaginal discharges of any character. They may also be introduced upon a dirty sound or catheter. On the other hand, the bacteria may lie dormant and unsuspected in the patient's own urethra, concealed in the crypts and follicles or the folds of mucous membrane, and may be lighted into activity through overindulgence in alcohol, intense erotic excitement, excessive coitus, or traumatism produced by the passage of a sound.

The inflammatory process in a simple urethritis is less severe than in the gonorrhœal form, and it is limited to the mucous membrane, without involving the submucous tissues.

TREATMENT.

The treatment consists in hygienic measures, rendering the urine bland, and the use of a mild astringent injection which answers very well for the light cases. If irrigations are used, the nitrate of silver (1 in 4000) frequently causes a prompt subsidence of the discharge, because the micro-organisms do not penetrate deeply into the tissues, but grow on the surface of the mucous membrane. Here the irrigation of nitrate of silver comes in direct contact with them and destroys them, and at the same time causes a desquamation of the superficial cells upon which the germs have proliferated. One or two irrigations may succeed in ridding the tissues of micro-organisms and infiltrated epithelial cells.

GONORRHŒA.

Gonorrhœal inflammation of the urethra is caused by the **gonococcus of Neisser.** The period of incubation is usually from four to seven days, but in rare instances may extend to fourteen days.

PATHOLOGY.

The gonococci are introduced into the urethra, usually in utero-vaginal secretions or upon an infected instrument. They do not remain upon the free surface of the urethral mucous membrane, but rapidly penetrate between the epithelial cells, and are to be found in the submucous connective tissue itself. They increase and multiply in colonies, in the interepithelial spaces and upper layers of the submucous connective tissue, and the toxic substances which they produce cause reaction on the part of the tissues, which is characterized by dilatation of the blood-vessels and discharge of serum and leucocytes. The cylindrical epithelium cells lining the urethra are loosened by the flow of secretion and are desquamated, forming **erosions** of the epithelial surface.

An active process of **phagocytosis** takes place, by which the gonococci are taken into the pus-cells and thus removed from the tissues, and, in cases which run a normal course, the gonococci have almost entirely disappeared from the submucous connective tissue and deeper layers of the mucous membrane by the end of the second or third week.

When the *stage of decline* commences, the epithelial erosions begin to undergo repair, by being covered with squamous epithelium in many layers. The gonococci which have been removed from the deeper tissues now begin to grow luxuriantly on the free surface of the mucous membrane after the manner of a sod of grass, and a desquamation of the upper layer of the newly-formed epithelial cells takes place, carrying with them their attached colonies of gonococci.

In normal and ordinary cases the process of getting rid of the gonococci is accomplished in the *ascending stage* by ***phagocytosis***, and in the *stage of decline* through *desquamation* of the ***epithelial cells***; so that in the fifth or sixth week, in favorable cases, the gonococci have disappeared entirely from the urethra, and the inflammation ceases.

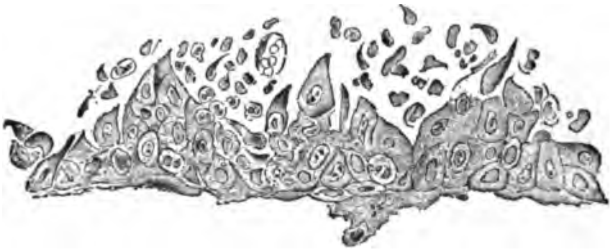


Fig. 4.—Gonorrhœal Conjunctivitis. Invasion of Epithelial Layer by Gonococci, and Desquamation of the Superficial Layers of Cells.

Morgagni's crypts and Littré's glands are also affected by the inflammatory process, which occurs *within* their cavities as well as around them, and the cavities of the glands act as foci of suppuration and incubating places for gonococci for months after the inflammation has ceased on the free surface of the mucous membrane. An **Infiltration of small round cells** which are derived from a proliferation of the fixed connective-tissue cells, and from leucocytes which have escaped from the capillaries, occurs as part of the process of inflammation, and may be **(a) superficial**, or confined to the mucous membrane and its connective-tissue layer immediately underneath, and dipping down and surrounding Morgagni's crypts and Littré's glands, or may be the **(b) deep form,** in which, in addition to affecting the mucous membrane and glands, the small round-celled infiltration involves the *deeper* submucous tissues, extending into the spongy tissue of the corpus spongiosum, in severe cases. The crypts and follicles are usually surrounded by and imbedded in the small round-celled infiltration.

Healing of the lesions is brought about by a removal from the tissues of the gonococci, through (*a*) phagocytosis, and (*b*) desquamation of the epithelial cells, which have been invaded by the gonococci. When the gonococci have been entirely removed suppuration ceases.

The *erosions* either (*a*) become covered with squamous epithelium in many layers, which offers a barrier to the renewed invasion of the tissues by gonococci, or (*b*) the erosions remain without being covered by squamous epithelium, but become the seat of *granulations,* and occasion a gleety discharge.

The *small round-celled infiltration* (*a*) disappears by absorption, especially when superficial and confined to the mucous membrane, and the urethra becomes healthy, soft, and flexible, or (*b*) the small round-celled infiltration is *not* absorbed, especially when deep seated, —*i.e.*, involving submucous tissue and cavernous tissue of the corpus spongiosum,—but becomes *transformed* into *true fibrous connective* tissue, called *stricture.*

Relapses are frequent, and are due to reinfection of the submucous tissues from a focus of suppuration located either in (*a*) Morgagni's crypts or Littré's glands, (*b*) the seminal vesicles, or (*c*) Cowper's glands or the prostatic crypts.

The manner in which a relapse takes place is as follows: If premature coitus or an excess of beer is indulged in, hyperæmia of the mucous membrane, with increased secretion, follows and the protecting layer of squamous epithelium is torn asunder. The gonococci penetrate through these clefts into the deeper tissues and again cause their irritative symptoms.

If the gonococci remain in the urethra for a considerable length of time a state of tolerance of the tissues is established and with each successive relapse the inflammatory reaction becomes less and less until, with the third or fourth relapse, the energy of reaction is not enough to bring the gonococci out of the submucous tissues. As a consequence, the gonococci remain and give rise to a permanent irritation of the submucous connective tissue, an infiltration of small round cells occurs, and the gonorrhœa becomes *chronic.*

COURSE.

The inflammation begins at the meatus, and in *favorable* cases affects the *anterior* urethra only, stopping at the cut-off muscle.

Stages.—*Prodromal.*—The symptoms are a slight tickling at the meatus, and a light-bluish sticky discharge with some slight stinging on urination. These last a couple of days, and then begins the *increasing stage*: The amount of pus increases. It is creamy yellow in color or greenish yellow from admixture with blood. Hæmorrhages may occur. The pain on urination is intense, and is occasioned by the sudden distension of the infiltrated walls of the urethra by the outflow of urine. Neuralgic pains in the back, perineum, groin, and spermatic cord are present. Constitutional disturbance in the shape of fever and a feeling of prostration often occurs. The prepuce may become œdematous and cause phimosis or paraphimosis.

Chordee is of frequent occurrence. It consists in an erection of the penis, with a painful incurvation downward. It is caused by an infiltration into the spongy tissue of the corpus spongiosum which surrounds the urethra and renders it rigid and inextensible. On account of the rigidity of the urethra the stream becomes small and twisted, and dribbling after urination occurs.

This condition continues without change for the better for about three weeks, and during this time it is known that the gonococci have been proliferating in the submucous tissues. At the moment when the gonococci have been removed from the deep tissues and begin to grow upon the free surface of the mucous membrane, the acute symptoms subside, and usually in the course of the third week the *stage of decline* begins. The pain on urination and the chordee lessen, the discharge becomes more watery and less in quantity, until it finally diminishes to a drop in the morning, which ultimately disappears.

Endoscopic examination, or the introduction of any instrument, should be strictly avoided in the acute stage. But if an endoscope were used, the appearances would be as follows:—

The mucous membrane appears swollen, œdematous, intensely red, and covered with pus. The glands and follicles are very markedly affected. The mucous membrane around their openings is more swollen and the openings themselves gape. Erosions, from desquamation of the cylindrical epithelium, appear in the vicinity of the glands. Granulations may form upon the erosions, later in the course of the disease. The submucous tissue is infiltrated, rendering the canal swollen and rigid.

Examination of Urine.—The two-glass urine test should be made at each visit to determine:—

(*a*) If the *posterior* urethra has been affected.

(*b*) The amount of pus secreted.

The urine passed into a glass appears turbid from admixture with pus, and little clumps or masses of desquamated epithelium are present. After standing, the pus settles to the bottom of the glass, and a cloud of mucus appears floating above it. As the case goes on toward recovery the pus disappears, but the hypersecretion of mucus continues, and occasions a cloudy appearance in the urine, resembling mucilage added to it.

After the mucus disappears *clap-shreds* persist for months, showing that *isolated portions* of mucous membrane are ***not covered*** with *epithelium*, and are *still secreting pus.*

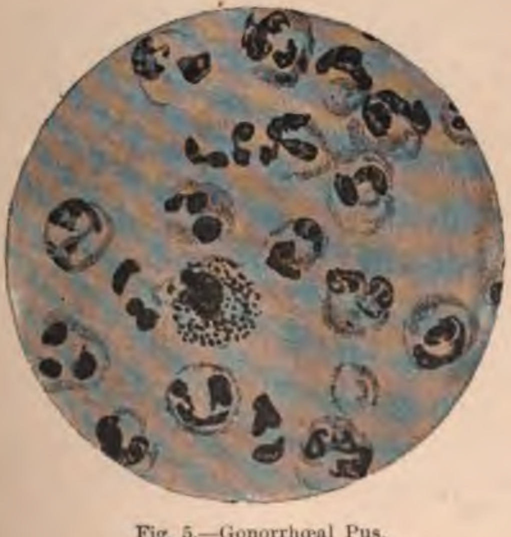


Fig. 5.—Gonorrhœal Pus.

Microscopic Examination of Pus.—In the ascending stage numbers of pus-cells are present containing gonococci *within* the cell. In the *stage of decline* a diminution is noted in the number of pus-cells, fewer gonococci are present, and squamous epithelial cells make their appearance. Finally the pus-cells and gonococci disappear, and squamous epithelium alone is found.

It is of the *utmost importance* to make sure of the entire disappearance of all gonococci before permitting coitus, on account of the danger of infection, in case the gonococci are not removed.

If no purulent discharge is obtainable from the meatus it is proper to excite a simple urethritis, by injecting the urethra with nitrate-of-silver solution gr. x to the ounce.

If gonococci are lurking in the crypts or a granular patch, the suppuration caused by the injection will bring them to the surface, and they can be found by microscopic examination of the discharge.

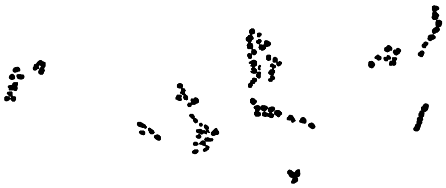


Fig. 6.—Gonococci Growing in Clusters.

MORPHOLOGY OF THE GONOCOCCUS.

The gonococcus resembles in appearance two coffee-beans placed side to side, and, as it is removed by phagocytosis from the tissues, will of necessity be found lying *within* the pus-cells. A few gonococci may be found outside the pus-cells, if these have been ruptured. In the descending stage of gonorrhœa the gonococci are found adherent to and growing upon the desquamated squamous epithelial cells.

Other micro-organisms—for example, the pseudo-gonococcus—which are not pathogenic resemble the gonococcus in shape, but it is believed to-day that the gonococci can always be recognized by decolorizing them by Gram's solution.

The microscopic examination for the gonococcus is pursued as follows in the Hoagland Laboratory, after the method of A. Hymans Van den Bergh:—

I. Make a thin smear on a cover-glass of the pus supposed to contain the micro-organisms.

II. Dry in the air and then fix over a flame.

III. Stain in Löffler solution of methylene-blue (prepared by Eimer & Amend) for $^1/_2$ to 1 minute.

IV. Wash in water, dry, mount in balsam, and examine.

The gonococcus is found on examination to be stained blue. In order to differentiate the gonococcus from the pseudo-gonococcus or other similar organisms, Gram's method of decolorization may be used, and if, after using it, the micro-organisms are found to have lost their blue color and become colorless, the diagnosis of gonococcus is established.

If, on the other hand, the micro-organisms still retain the blue color, it is a proof that they are not gonococci.

Gram Method.—I. Stain in aniline-water gentian-violet for one minute.

II. Pour off stain and wash or blot gently.

III. Place in Gram's solution 1 minute.

IV. Decolorize in absolute alcohol 2 $^1/_2$ to 3 minutes.

V. Dry and mount in balsam.

VI. Examine.

The gonococcus is found to be decolorized, but other micro-organisms retain the blue color.

Formulæ.—To make aniline-water shake up 5 cubic centimetres of aniline-oil in 100 cubic centimetres of plain water. Shake violently, and filter through a wet filter.

Gentian-violet.—To 1 cubic centimetre of saturated alcoholic solution of gentian-violet add 20 cubic centimetres of aniline-water.

These added together make aniline-water gentian-violet, which does not keep, as a mixture, more than a week.

Gram's Solution.—Iodine crystals, 1 gramme; potassium iodide, 2 grammes; water, 300 cubic centimetres.

DURATION OF AN ATTACK OF GONORRHŒA.

When the posterior urethra is not affected a favorable case of gonorrhœa recovers in six to eight weeks. In very exceptional instances recovery may occur in three to four weeks, but in these cases there is always a doubt as to the correctness of the diagnosis of true specific gonorrhœa.

The first attack is the most severe, but most liable to recover without stricture. Later attacks are apt to follow the course of the first one, in having a repetition of the complications.

The causes which retard recovery may be grouped as follows:—

(*a*) Complications, posterior urethritis, prostatitis, etc.

(*b*) Reinfection from a urethral gland, seminal vesicle, prostate, etc.

(*c*) Lack of rest.

(*d*) Habits of drinking.

(*e*) Injections which are too strong or too frequently repeated.

(*f*) Constitutional causes: *i.e.*, gout, tuberculosis, etc.

(*g*) Premature coitus.

TREATMENT.

Gonorrhœa is a *self-limited* disease, and the suppuration may be looked upon as an effort on the part of the tissues to remove the invading micro-organisms; so that when the last gonococcus is removed suppuration ceases.

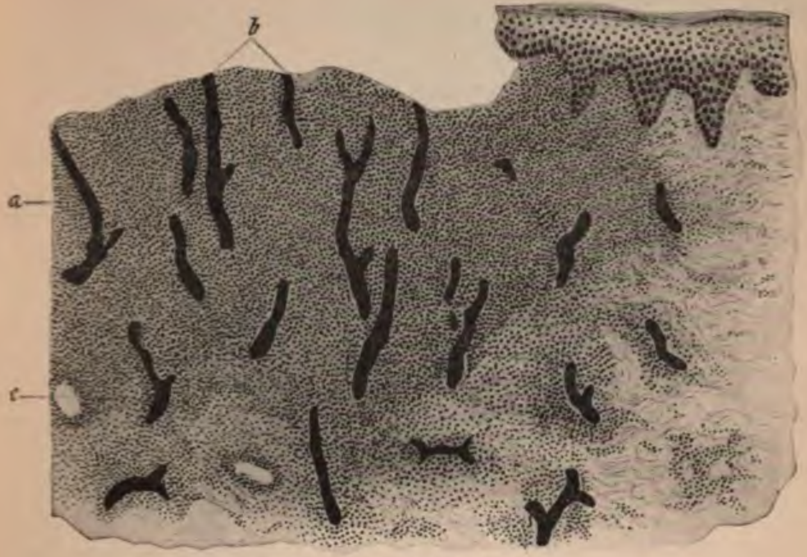
An **expectant** plan of treatment can only be carried out exceptionally, as in military hospitals, for instance. Here it is found that if a patient with gonorrhœa is put to bed and fed on a bland diet, consisting chiefly of milk, in forty-five days, on an average, the gonococci are eliminated from the tissues and the suppuration has ceased. Under the existing social and business conditions, however, such a plan of treatment is practically impossible, and we have to adopt the methodic treatment.

As the gonorrhœal inflammation begins at the meatus and does not reach the posterior urethra until the third week, or in favorable cases not at all, we will first consider the treatment of inflammation which is limited to the anterior urethra, and take up posterior urethritis in a subsequent section.

ANTERIOR URETHRITIS.

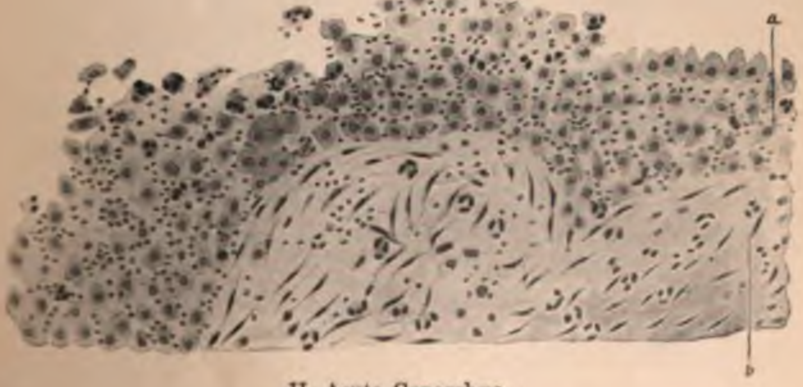
Methodic Treatment.—There are certain **hygienic** directions which the patient should observe: he should keep quiet and spend as much time lying on a sofa or bed as possible, and should, of course, avoid all sources of sexual or erotic excitement. He should be warned of the danger of gonorrhœal ophthalmia, and directed to wash his hands after handling the penis or dressings, to avoid carrying any pus into the eyes.

The **diet** should be non-stimulating, and the patient should avoid meat in excess, highly seasoned or salty foods, sauces, condiments, strong tea or coffee, pickles, tomatoes, asparagus, and alco-



I. Section of Chancroid.

a, Small round-celled infiltration.
b, Lymphatics, open and gaping.
c, Blood-vessel.



II. Acute Gonorrhœa.

a, Cylindrical epithelium, infiltrated with pus-cells and gonococci.
b, Submucous connective tissue, with pus-cells and gonococci.

(From "Die Syphilis und die Venerischen Krankheiten," von Dr. Ernest Finger.)

holic drinks of all kinds, of which beer and champagne are especially detrimental.

Dressings for the purpose of catching the discharge and keeping it from the clothing are always necessary. The best form is made by cutting off the foot of a stocking and placing some absorbent cotton at the bottom; the penis is placed within it and the bag suspended from a waist-band.

Constricting the penis by wrappings should be carefully avoided, so as not to interfere with the return-circulation. If the discharge is but trifling, a pledget of cotton may be placed under a long foreskin to absorb it; but the cotton is not to be recommended if the discharge is profuse, as it will prevent the pus from flowing out freely from the meatus, and cause it to dam back.

A *suspensory bandage* should be worn in every case to relieve the sensation of *dragging* on the spermatic cord and perhaps lessen the danger of epididymitis.

Therapeutic Treatment.—The *balsams* of copaiba, cubebs, and sandal-wood oil have had for years a well-deserved reputation as anti-blennorrhagics. They are eliminated by the kidneys, and affect the inflamed urethra as they pass over it, held in solution in the urine.

Sandal-wood oil is best adapted to the increasing stage, but acts well throughout the whole course of the disease. The balsams of copaiba and cubebs have fallen largely into disuse, but are sometimes serviceable in the descending stage of a gonorrhœa.

The dose of sandal-wood oil and the balsams is from 15 to 20 drops in capsules, three times a day.

Sandal-wood oil sometimes causes an intense pain in the back, or disagrees with the digestion, and has to be abandoned on these accounts, while copaiba often causes an erythematous eruption resembling measles.

While sandal-wood oil and the balsams are a useful adjuvant in gonorrhœa, it is necessary to have recourse to other measures to effect a cure.

Treatment of the Increasing Stage.—The bowels should be regulated by a saline cathartic given every second morning before breakfast, which depletes the pelvic blood-vessels and lessens congestion.

Alkalies or an alkaline mineral water should not be prescribed as a routine measure, for an alkaline reaction of the patient's urine is always caused by his abstinence from meat and his free use of milk, and the best prophylactic against the development of cystitis in gonorrhœa is a strongly *acid reaction* of the urine, which inhibits the growth of any bacteria which may find their way into the bladder.

Diluents.—The patient should be directed to drink considerable quantities of pure distilled water—a glass every hour or two, with the object of *washing out* the urinary passages and keeping the urethra free from secretions which would otherwise form excellent culture-media for gonococci.

Sandal-wood oil is administered by the mouth, preferably in capsules. The well-known Lafayette mixture is commonly used in hospital and dispensary practice, but it has the disadvantages of containing an alkali and of having an abominable taste. Its formula is as follows:—

℞ Extracti hyoscyamus fluidi	fʒss.
Potassii citratis	℥j.
Olei santali flavi	f℥ss.
Aquæ destillatæ	f℥ij.
Syrupi acaciæ	q. s. ad f℥vj.
Olei gaultheriæ	fʒss.

M. Sig.: Two teaspoonfuls at a dose.

The *burning* on *urination* is lessened in some degree by the sandal-wood oil, but if very severe can be relieved by injecting ʒss of 4-per-cent. cocaine solution into the urethra.

The local treatment by means of astringent injections is ***entirely contra-indicated*** during the ascending stage, for, as we have already noted in considering the pathology, the gonococci at this time are in the upper layers of the ***submucous connective tissue*** and the *deeper cells* of the mucous membrane, and they are being removed from the deeper tissues as rapidly as possible by the phagocytic action of the leucocytes. Under these conditions the action of an astringent is to hinder the elimination of the gonococci from the depths, and so retard the natural healing process.

A pure antiseptic, however,—such as some of the new silver salts or irrigations of permanganate of potash by the Janet method,—is entirely in order, and is effectual in moderating the severity and shortening the duration of the disease.

Treatment of the Stage of Decline.—In the third week the ascending stage has usually passed its acme, the chordee lessens, and the pain on urination is diminished. The character of the discharge also changes. It is no longer thick yellow or greenish pus, but is thinner, contains more mucus, and is whiter and more watery in color. When these conditions occur, the administration of sandalwood oil can be stopped and balsam copaiba, or oleoresin of cubebs substituted.

The use of *astringent injections* should be strictly *avoided until the stage of decline*, for the reason that, as stated before, in the ascending stage the gonococci are in the deeper layers of the mucous membrane and subepithelial tissues, and they cannot be destroyed, at this time, by the use of astringents, which also act as chemical irritants and interfere with phagocytosis.

The improvement in the symptoms of the patient is caused by the fact that in the stage of decline the gonococci have been eliminated from the *deep* tissues and are now growing on the *free surface* of the mucous membrane of the urethra, and the erosions are being healed by the formation of squamous epithelium.

These facts can be demonstrated by finding, with the microscope, colonies of gonococci growing on desquamated cells of epithelium, which are contained in the discharge.

Under these conditions a combination of an astringent and an antiseptic as an *injection* is called for, in order to destroy the gonococci, heal the erosions, and contract the dilated blood-vessels.

Syringes are of various shapes and made of soft rubber, hard rubber, and glass. An important point to observe is that the nozzle is not prolonged into a snout, which would irritate the mucous membrane of the fossa navicularis. In addition, it is essential that the syringe should hold from three to four drachms of fluid, so that when the injection is given the folds of the urethra may be fully distended.

Technique of Injecting.—The patient urinates to cleanse the urethra, and then, holding the penis in the left hand, draws it out, while with the right hand the injection is slowly forced from the syringe into the urethra and held for two to five minutes. It is not necessary to make pressure on the perineum to keep the fluid from entering the bladder, as the fluid is kept from flowing backward by the tonic contraction of the cut-off muscle.

Formulæ for Astringent Injections.—

℞ Zinci sulphatis	gr. i-v.
Aquæ	f℥j.

℞ Zinci permanganatis	gr. j.
Aquæ	f℥viij.

℞ Argenti nitratis	gr. j.
Aquæ	f℥j.

℞ Zinci sulphatis	gr. xv.
Plumbi acetatis	gr. xxx.
Aquæ destillatæ	q. s. ad f℥vj.

M. Sig.: Insoluble. Hold in urethra and let out drop by drop.

℞ Extracti hydrastis fluidi (non-alcoholic)	fʒss-j.
Aquæ	f℥j.

M. Sig.: For muco-purulent discharge where simple astringent is indicated.

Ultzmann's Injection.—

℞ Zinci sulphatis	gr. iv-xij.
Pulvis aluminis	gr. iv-xij.
Acidi carbolici	gr. iv.
Aquæ	f℥iv.

The above is particularly useful in the stage of decline where discharge fails to diminish under other applications.

℞ Bismuthi subnitratis	gr. xl.
Mucilaginis acaciæ	℥j.
Aquæ	q. s. ad f℥iv.

M. Sig.: Shake well. Use once a day at bed-time and hold in urethra five minutes.

The Use of Injections.—An astringent injection should never be used in the presence of posterior urethritis nor in the *ascending stage* of a gonorrhœa, for until the stage of decline sets in the gonococci lie deep within the tissues and entirely out of reach of astringents applied to the surface of the mucous membrane. In addition to being of no value in destroying the gonococci, astringents are actually harmful from the irritation of the tissues which their use entails.

In the *stage of decline*, however, when the burning on urination is decreased and the discharge has become thin and watery, the gonococci are growing upon the free surface of the mucous membrane and can be destroyed by the application of the various injections which combine an antiseptic and astringent. At the same time the dilated blood-vessels are contracted by the astringent and the inflammation, through their agency, is lessened.

An injection should never cause more than a slight burning. After a time the urethra becomes *tolerant* of *one* form of injection, and it is necessary to increase its strength or to change the formula.

The prolonged use of an injection may in itself induce an irritation of the mucous membrane of the urethra, which is evidenced by shreds in the urine, and the formation of a slight amount of secretion, which causes the lips of the meatus to stick together.

In order to determine if the treatment is responsible for keeping up the discharge, it is desirable to stop the use of the injection for forty-eight hours, to see if the last traces of inflammation will not disappear spontaneously.

If at the end of this time the discharge still persists in small quantity and on microscopic examination the shreds are found to be made up of squamous epithelium and contain no gonococci, an injection of bismuth used at night, which acts mechanically by coating over the mucous membrane, frequently causes a cessation of the catarrh in six or eight days.

The patient, however, cannot be considered cured until he has resumed his ordinary way of life for some days and remained free from a relapse, because a few gonococci may have lain unsuspected in a crypt or follicle and on slight provocation come to the surface and cause a reinfection.

The abortive treatment of gonorrhœa, by means of *strong* solutions of nitrate of silver, injected into the urethra or applied through an endoscope, is not to be recommended. The micro-organisms lie deep in the tissues, and cannot be reached by applications made upon the surface of the mucous membrane, and an increased irritation of the tissues is sure to follow, without any shortening of the course of the disease.

Irrigations with Permanganate of Potash: Janet's Method.—In the last few years the treatment of gonorrhœa, suggested by Janet, of Paris, by means of irrigations of permanganate-of-potash solution, has been extensively used. Its adherents are enthusiastic in praise of its merits, Goldberg, of Cologne, citing statistics showing that 90 per cent. of the cases of gonorrhœa were cured in fourteen days by this means.

The permanganate irrigation is a valuable method of treating gonorrhœa, but these claims as to its advantages would seem to be extravagant. According to the experience of other men who use this form of treatment, it is impossible to attain any such results, and many specialists have given up the method in disgust, after a fair trial.

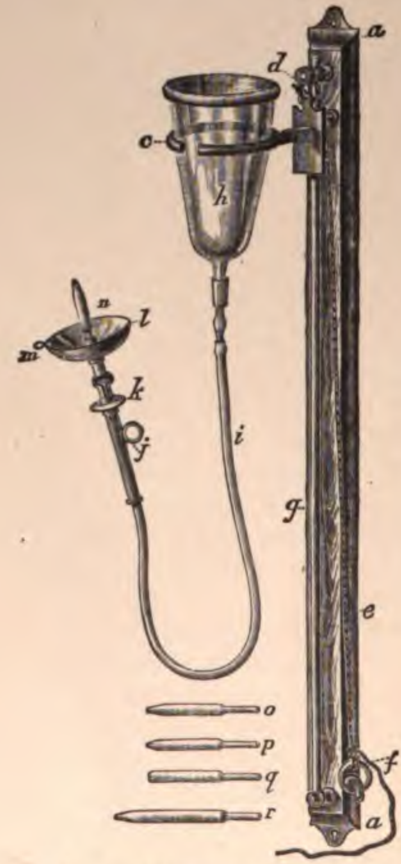


Fig. 7.—Valentine's Irrigator.

From the author's reading and experience with the Janet method, the following would seem to be a fair estimate of its value:—

The profuse purulent discharge is checked, in most cases, in about eight days; but even under treatment *relapses*, accompanied by a free discharge of pus, occur in nearly every case, without apparent cause, and often several times. These relapses yield promptly to irrigations of permanganate, but the convalescence is retarded, and the irrigations have to be continued daily to hold the pus in check and to control the thin, serous discharge which lasts after suppuration ceases. The course of the case is in this way dragged out; so that at least one month, and very often two months or more, are required to effect a cure.

The *advantages* of the method are that posterior urethritis is of exceptional occurrence. The discharge from the meatus is so slight as not to cause any inconvenience, and there is no burning on urination and no chordee.

The *disadvantages* of the Janet method are the expense, trouble, and inconvenience entailed upon the patient by being obliged to report at his physician's office once or twice a day for treatment.

The objection which has been raised, that the frequent irrigation of the bladder or the relaxation of the cut-off muscle will in time do harm, is, I believe, entirely unfounded.

In order to cut short the course of the gonorrhœa by Janet's method it is necessary to begin treatment *early* in the ascending stage.

Technique.—The patient sits easily, well forward on a chair, and rests his back against the back of the chair. The irrigator nozzle is inserted into the meatus and the anterior urethra washed out. If it is desired that the fluid should enter the bladder, the irrigator is elevated to the height of nine feet from the floor. The patient is instructed to take a long breath and attempt to urinate. As soon as the cut-off muscle is relaxed the solution from the irrigator flows into the bladder, and when the bladder is filled the patient stands up and urinates, and the solution flows out through the urethra.

The urethra is irrigated twice a day for the first week, and then once a day till the patient is cured. The first irrigation is used of a strength of 1 to 1000 for its abortive effect, in the anterior urethra alone, and the second time of a strength of 1 to 6000. From this time on the strength of the solution should be 1 to 3000.

As a rule, the first irrigation diminishes the secretion materially, and when after a few days the secretion is scanty in amount and thin the irrigation is allowed to flow through the posterior urethra into the bladder.

After the first week one irrigation a day is sufficient, and the strength may be increased to 1 in 1500, unless it causes tenesmus and bladder irritation.

The effect of permanganate irrigations is to cause energetic disinfection of the mucous membrane by removing and mechanically washing away accumulated secretions, as is the case with the irrigation of any suppurating wound-cavity. The permanganate also causes an œdematous swelling of the epithelial cells, which inhibits the growth of colonies of bacteria.

It has been suggested recently that, after the discharge is reduced, at the end of the first week, the destruction of gonococci may be hastened by allowing the patient to use Protargol or Largin as an injection, and when the case has progressed so far that there is no more pus-formation, but only a slight serous discharge and shreds in the urine, an astringent injection may complete the cure.

The Salts of Silver.—In the last couple of years various combinations of silver with an albuminoid base, such as Protargol, Largin, Argonin, and Argentamin, have been introduced for the treatment of gonorrhœa.

According to Finger,[1] Protargol and Largin may be regarded as pure antiseptics without astringent properties and entirely unirritating to the tissues; so that they can be used in the ascending stage. They are in the form of a soluble albuminate of silver, which does not coagulate the tissues, and has the power to penetrate deeply and destroy the gonococci which lie under the mucous membrane.

The action of the silver salts is incomplete, and they do not destroy *all* the gonococci, particularly those in the mucous crypts and follicles; so that if their use is discontinued too soon a relapse is liable to occur.

It has been found experimentally that Protargol and Largin must remain in contact with the tissues for 10 minutes, in order to exert their destructive action upon the gonococci. A shorter time is insufficient, and fails.

Another advantage possessed by Protargol and Largin is that, in cases where the inflammation has passed beyond the cut-off muscle and attacked the posterior urethra, on holding a solution of either drug in the urethra for a short time the cut-off muscle relaxes, on account of the mild and unirritating character of the remedies, and allows the solution to flow back and come in contact with the posterior urethra and exercise its bactericidal power.

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[1] Wiener Klinik, January, 1900.

If a strong and irritating solution, like nitrate of silver, is injected into the anterior urethra, a reflex contraction of the cut-off muscle is always caused.

In the ascending stage of gonorrhœa Protargol and Largin are the most useful of the silver salts; but in the stage of decline the gonococci are no longer in the deep tissues, but superficially seated. The indication at this time is to destroy them on the surface of the mucous membrane and at the same time exert an astringent effect upon the dilated vessels. Argonin and Argentamin are astringents in addition to being germicides, and are indicated in this stage.

Method of Using.—The use of Protargol solution ($^1/_4$ to 1 per cent.) should be begun at once in the ascending stage, and the patient should be instructed to make the injections eight hours apart. This is said to be an important point. Before using the injection he should urinate, and, as urine decomposes the silver solutions, he should wash out the urethra with 2 or 3 syringefuls of warm water. The injection should be warmed before using, the syringe should contain 3 to 4 drachms in order to distend the folds of the urethra, and the solution should be retained in the urethra from ten to fifteen minutes.

In the course of a few days the acute symptoms subside and the pain on urination and chordee disappear. It should be noted that, if treatment be discontinued at this point, even though the discharge has ceased and only a few shreds remain in the urine, a relapse is certain to occur in from two to three weeks, for a few gonococci have been left which were not destroyed, and reinfection occurs.

With the subsidence of the acute symptoms the strength of the Protargol solution may be increased to $^1/_2$ or 1 per cent., and it should be used three or four times a day.

After Protargol has been continued a few days longer it is desirable to discontinue its use and begin with Largin solutions, commencing with $^1/_4$-per-cent. solutions and increasing to $^1/_2$ and 1 per cent., three times a day.

It is proven that, while Largin is not a neutral solution and has slightly irritating qualities, it possesses the power of penetrating more deeply than Protargol, and destroying the gonococci lying in the deep tissues.

After a few days more of treatment the discharge ceases entirely, but few shreds are present, and the gonococci are only found in very small numbers in the secretions; but, if the injections are stopped, the gonococci still remaining increase in numbers, and cause a relapse.

The indications at this time are to destroy the few remaining gonococci and to cure the catarrh of the mucous membrane.

This is accomplished by the combined use of antiseptics and astringents, and to that end 1-per-cent. Largin solution may be used once a day, and Ultzmann's injection of zinc, alum, and carbolic acid twice a day.

Later on, when the number of shreds is very much reduced, Largin may be used twice a day and either nitrate of silver or Argentamin solution ($^1/_4$ or $^1/_2$ of 1 per cent.) may be injected once daily.

A great advantage of the treatment with silver salts, which may also be assisted by the internal use of sandal-wood oil, is that the disinfection of the tissues advances rapidly and the spread of the inflammation is checked; so that, while under ordinary treatment posterior urethritis occurs in 80 per cent. of the cases, in the patients treated with silver salts posterior urethritis is observed in from only 30 to 40 per cent. of cases.

In point of time, while a small percentage of cases are cured in from two to three weeks, under the treatment with silver salts, in the great majority of patients in which complications do not occur a continuous course of medication of five to six weeks is required in order to effect a cure.

CHAPTER IV.

POSTERIOR URETHRITIS.

POSTERIOR urethritis consists in an inflammation of the mucous membrane of the posterior urethra, which lies behind the cut-off muscle. In severe cases the inflammation may extend up out of the urethra and involve the base of the bladder.

Acute posterior urethritis is almost always caused by the extension of a gonorrhœal or simple urethritis from the anterior part of the canal; but the *subacute and chronic forms* may be the result of prolonged congestion from sexual abuses, complicated by germ infection from the rectum or from without.

Posterior urethritis is a serious complication of gonorrhœa, because

I. It increases the extent of the inflamed surface and renders recovery more remote.

II. On account of *complications,* which are almost sure to follow, if the pus is conveyed through the various ducts opening into the posterior urethra, to the prostate, seminal vesicles, testicles, and bladder.

Posterior urethritis occurs in 80 per cent. of cases of gonorrhœa, but is often so mild as to be overlooked. It usually develops from the second to the fourth week, or when the gonorrhœal inflammation has extended to the bulb. It may be excited by the use of a sound or catheter in an acutely inflamed urethra, which pushes the pus along in front of the instrument or causes traumatism, or it may develop spontaneously.

The membranous urethra, in certain cases, acts as a barrier to the spread of an inflammation from the anterior urethra backward toward the bladder. The cut-off muscle, which surrounds the membranous urethra, is in a state of tonic contraction, and acts like a valve, and the mucous membrane lining the membranous urethra is less vascular and provided with fewer crypts and follicles than either the anterior or posterior urethra, and also serves to check the extension of the gonorrhœa.

Clinically two forms of posterior urethritis are met with: **(a) mild or subacute form; (b) severe form.**

SYMPTOMS.

The symptoms of the **mild form** may be so slight as not to attract attention. There is an ill-defined sense of weight over the pubes and a feeling of pressure in the perineum, together with slightly increased frequency of urination.

The symptom of increased frequency of urination depends upon the fact that, in a condition of health, the posterior urethra is the most sensitive part of the canal, and, when the bladder becomes filled and a few drops of urine trickle into the posterior urethra, their presence sets up a certain physiological irritation, which is transmitted to the bladder, and produces a contraction of its muscular walls, which empties the bladder of its contained urine.

In posterior urethritis there is a congested state of the prostatic urethra and an abnormally acute sensitiveness; so that the stimulus to urinate is greatly increased.

In the **severe form** of posterior urethritis the symptom of frequent and painful urination is very much aggravated. If the inflammation is very acute and particularly if it has extended to the base of the bladder, violent vesical tenesmus sets in, which the patient cannot restrain.

The squeezing together of the inflamed surfaces, by the muscular contractions of the bladder, not only causes intense pain, but also often ruptures some of the capillaries in the mucous membrane; so that a few drops of blood generally follow the act of urination.

No sooner has one spasmodic contraction of the bladder subsided than another one sets in, and these continue to recur every few minutes until the suffering becomes almost unbearable.

DIAGNOSIS.

The diagnosis of the **severe** form of posterior urethritis can usually be made from the symptoms alone, but the **mild form** is apt to be overlooked, unless we direct our patient with gonorrhœa to urinate in two glasses, each day we see him, and in this way we can detect inflammation of the posterior urethra in its incipiency.

The **two-glass urine test**, as devised by Sir Henry Thompson, is based upon the physiological action of the cut-off muscle, which, by its tonic contraction, forms a barrier between the anterior and posterior urethra. Fluids injected into the anterior urethra cannot flow back into the bladder, and pus lying in the posterior urethra is prevented from flowing out through the anterior urethra, but escapes backward into the bladder, and renders the urine which had accumulated in the bladder turbid and cloudy.

If suppuration is going on in the anterior urethra (the posterior urethra being healthy), and the patient is directed to urinate, the first gush of urine washes out the pus, and the urine, if caught in a glass, appears turbid. If the remainder of the urine, which had collected in the bladder and is uncontaminated, is passed into another glass, the urine in the *second* glass is clear.

If suppuration is present in *both* anterior and posterior regions of the urethra, the *first* glass of urine passed is, of course, turbid, from the pus washed out of the urethra, and the *second* glass will be *turbid also*, because the pus formed in the posterior urethra flowed back and stained the urine which was contained in the bladder.

Turbidity of the urine is sometimes caused by urates or phosphates. If uratic in origin, the cloudiness clears up on boiling, and, if phosphatic in character, a few drops of nitric or acetic acid will render it clear. The presence of pus can be determined by microscopic examination or by adding a few drops of liquor potassæ to the suspected urine, in a test-tube, and twirling it rapidly. If pus is present it will be coagulated and float in long, ropy strings through the urine.

Chemical examination shows more albumin than can be accounted for by the pus. This superabundance of albumin is not occasioned by structural changes in the kidney, but to increased intrapelvic pressure, caused by the frequent and severe muscular spasms of the bladder.

TREATMENT OF THE MILD FORM OF POSTERIOR URETHRITIS.

The irrigation of the urethra and the bladder by means of an irrigator, after Janet's method, is particularly adapted to cases of inflammation of the posterior urethra developing in the course of a gonorrhœa. Irrigation of the posterior urethra can also be practiced by introducing a soft-rubber catheter beyond the cut-off muscle so that its eye lies in the posterior urethra, and injecting solutions through it by means of a large hard-rubber syringe. The best solutions to use are: Nitrate of silver, 1 in 4000 to 1 in 2000, or permanganate of potash, 1 in 6000 to 1 in 1500; and both, of course, should be used hot.

Instead of using copious flushings of the urethra, with a considerable quantity of fluid, we can deposit a few drops of a concentrated solution of nitrate of silver directly upon the surface of the mucous membrane by means of Ultzmann's syringe. The syringe is introduced past the cut-off muscle, so that the end lies in the posterior urethra, and 15 or 20 drops of the solution are injected. Nitrate of silver, in strength ranging from 1 to 5 grains, is the best application for the purpose.

If we desire to medicate the posterior urethra alone, the patient should retain some urine in the bladder. The urine will neutralize the solution as it flows into the bladder. If a urethro-cystitis be present, the patient should *empty* his bladder first, and the injected fluid will then medicate the posterior urethra and flow back and affect the base of the bladder as well.

As to a selection between the methods of irrigation and instillation, as a general rule, it is found that recent cases with an abundant purulent secretion and which are free from pain or other acute symptoms are most benefited by copious irrigations, and that after the discharge has diminished, so that the urine is clear and only shreds are present, instillations are more serviceable.

Diuretics—such as triticum repens, uva ursi, buchu, etc.—are not indicated in posterior urethritis, since, although they render the urine bland and unirritating, they increase the quantity secreted, and occasion more frequent calls on the bladder to empty itself.

TREATMENT OF THE SEVERE FORM OF POSTERIOR URETHRITIS.

In this form any kind of mechanical interference with the urethra—such as injections, irrigations, or the introduction of any instrument—should be *rigidly avoided.* The patient should go to bed in order to secure rest for the inflamed posterior urethra, lessen its congested condition, and so diminish the vesical tenesmus.

A mild saline cathartic is useful by reducing the congestion of the pelvic organs. Milk should be the staple article of diet, to render the urine bland and unirritating. *Sandal-wood oil* acts almost like a specific in some cases. After a few doses the tenesmus lessens and the escape of blood after urination ceases.

Alkalies or *alkaline mineral* waters are contra-indicated, for the reason that the urine in the bladder is necessarily neutral or alkaline in reaction, on account of the abstinence from meat and the milk diet ordered. If the urine becomes alkaline and pyogenic micro-organisms make their way into the bladder from without, a suppurative cystitis is almost sure to occur; so that a moderate degree of acidity of the urine is regarded as the best prophylactic against cystitis.

In order to maintain this condition of acid urine, it has been advised of late to administer *salicylate of soda*, gr. xx three times a day, as this drug has the property of causing a strong acid reaction in the urine.

Morphia is generally required to relieve the excessive tenesmus and allay the frequent desire to urinate. The frequent desire for urination has a bad effect upon the inflammation, since the contractions of the bladder cause an increase in the hyperæmia at its base. Morphia may be given by the mouth, but preferably in suppository.

Hot sitz-baths prolonged for half an hour and used several times a day sometimes lessen the tenesmus and desire to urinate; but, while useful as an adjuvant, they will hardly take the place of opium.

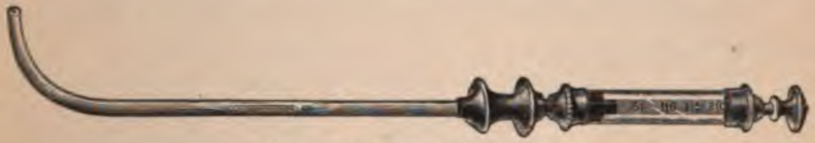


Fig. 8.—Ultzmann's Syringe.

When these methods fail to relieve the tenesmus and pain, which may be intense, the **instillation** of 10 drops of nitrate of silver with an Ultzmann syringe into the posterior urethra often succeeds in calming the disturbance in a few hours. We begin with gr. j to the ounce and increase up to gr. v to the ounce, using it every second or third day.

It is always better to use the instillation as a last resort, since we can lay it down as a rule from which there are few departures: "Never to introduce an instrument into a urethra affected with *acute* inflammation."

After acute symptoms have passed off the case assumes the characteristics of the *mild* form of posterior urethritis, and can be treated as such.

CHAPTER V.

CHRONIC URETHRITIS.

CHRONIC urethritis is one of the most obstinate and difficult affections to cure which the genito-urinary specialist is called upon to treat, unless the treatment is based upon a knowledge of the pathological changes which have taken place in the tissues, and the character and exact location in the urethra of the lesions.

A case of gonorrhœa may be called chronic when it has lasted for ten or twelve weeks.

Chronic urethritis is sometimes incorrectly called *"gleet,"* but the true *definition* of gleet is: *A chronic muco-purulent discharge produced in certain localized areas of the mucous membrane of the urethra which are in a state of chronic catarrhal or granular inflammation.*

The statement that every case of gleet is dependent upon a stricture is an incorrect one. A gleety discharge may be occasioned by superficial changes in the mucous membrane, which never produce any narrowing of the urethra. On the other hand, in cases where stricture does exist, the mucous membrane lying above is never healthy, and a gleety discharge is always present.

The **predisposing causes** of chronic urethritis may be summed up as follows: Anything which tends to prolong or prevent the natural healing of a gonorrhœa, such as: (*a*) Careless ways of living on the part of the patient. (*b*) Injections which are too strong or used too frequently. (*c*) Use of alcohol or beer. (*d*) Sexual intercourse or erotic excitement.

At other times cases which are properly treated and which have had good care become chronic, usually on account of some diathetic taint, either tuberculosis, rheumatism, gout, or sometimes incipient pulmonary phthisis.

It is convenient to study chronic inflammation of the ***anterior*** urethra by itself, although the posterior urethra is apt to be affected as well, at the same time.

CHRONIC ANTERIOR URETHRITIS.

PATHOLOGY.

As a result of gonorrhœa, particularly in its later stages, an *infiltration of small round cells* takes place. This infiltration is the most important characteristic of the disease, and most of the other changes in the tissues result from it. The small round cells originate partly from the capillary vessels of the mucosa and partly from a proliferation of the fixed connective-tissue cells.

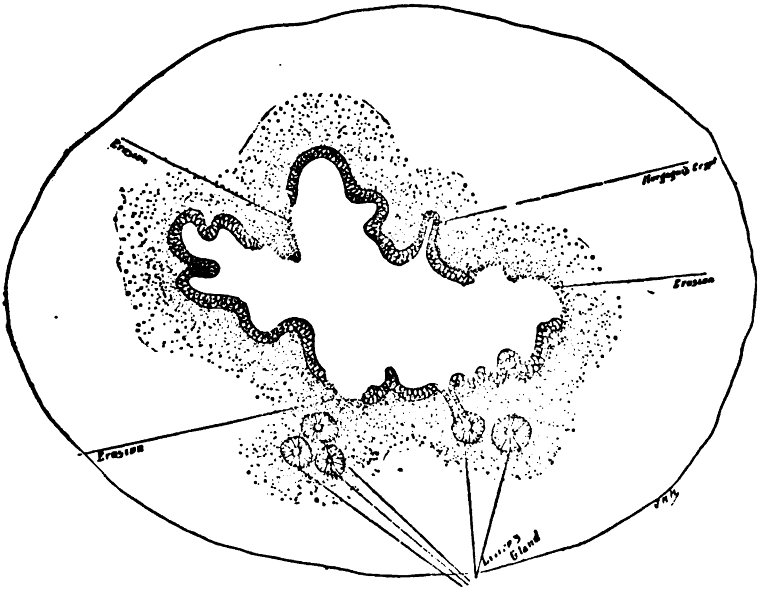


Fig. 9.—Diagram of a Cross-section of the Urethra, Representing the Histological Changes in Chronic Urethritis.

The small round-celled infiltration begins in the submucous connective tissue and surrounds the lumen of the urethra completely.

Its favorite points of location are most frequently around the bulbous urethra, and next in frequency at the fossa navicularis. These are the widest and most dilatable portions of the canal, and in acute gonorrhœa the stream of urine is not sufficient to wash out the pus, which stagnates here and acts as a focus for the renewed local infection of the tissues at these points.

The mucous glands and follicles (Littré's glands and Morgagni's crypts), which dip down into the meshes of the corpus spongiosum, are also surrounded by and imbedded in the infiltration.

Clinically we may classify the cases of chronic urethritis according to the extent of the infiltration into: (*a*) *superficial*, or *mucous*, form, in which the small round-celled infiltration is confined to the mucous membrane, subepithelial connective tissue, and periglandular tissue alone, and which is not followed by stricture, and (*b*) the *deep form* of infiltration.

In the latter class the infiltration extends *deeply* into the tissues, and involves the meshes of the corpus spongiosum extensively and is always followed by stricture.

Glandular Changes.—During the course of the gonorrhœa the gonococci penetrate into *Morgagni's crypts and Littré's glands* and set up an inflammation in the cavities, which is accompanied by an infiltration of small round cells *around* the ducts and walls of the glands (periglandular infiltration).

The infiltration around the duct stiffens it and keeps its mouth open and gaping, affording an open gateway for the escape of the inflammatory products which have formed within the cavity of the gland.

The gonococci may continue to propagate within the cavities of the glands for months, after the inflammation has entirely ceased on the free surface of the mucous membrane.

The reappearance of an acute purulent discharge containing gonococci, a so-called *relapse*, is due to an escape of gonococci from the glands and a reinfection of the surface of the mucous membrane.

Infection of wives and mistresses with gonorrhœa, during coitus, is often caused in the same way, viz.: the escape of pus-cells containing gonococci, which had been formed by the suppurative process continuing in the gland-cavities after the surface of the mucous membrane had been well for months. During intercourse the pus, mixed with seminal fluid, is deposited in the vagina of the female, and infection follows.

The inflammatory products, consisting of desquamated epithelial cells, pus-cells, and granular material, which stuff the cavities of the glands, are washed out by the act of urination and appear floating about in the urine as shreds.

The small granules are probably formed in the glands of the anterior urethra, and the larger plugs, shaped like a comma or tadpole (Fuerbringer's hooks), originate in the follicles of the prostatic urethra.

Larger "clap-shreds" are also always present, and are occasioned by the secretion from erosions drying upon the surface, forming a scab, which is washed away by the stream of urine.

Changes in the Mucosa.—During the acute inflammatory stage of a gonorrhœa the cylindrical epithelium lining the urethra is loosened and thrown off in patches, leaving superficial *erosions*. These losses of epithelium, except in very rare instances, are not deep enough to deserve the name of ulcers.

On account of the round-celled infiltration of the submucous tissues the erosions do not heal readily, but remain uncovered by epithelium for a long time.

The blood-vessels in the submucous tissues send up newly-formed capillary loops, which traverse the infiltration in an upward direction, and as they grow toward the surface penetrate the floor of the erosion and convert it into a bed of newly-formed *granulations*.

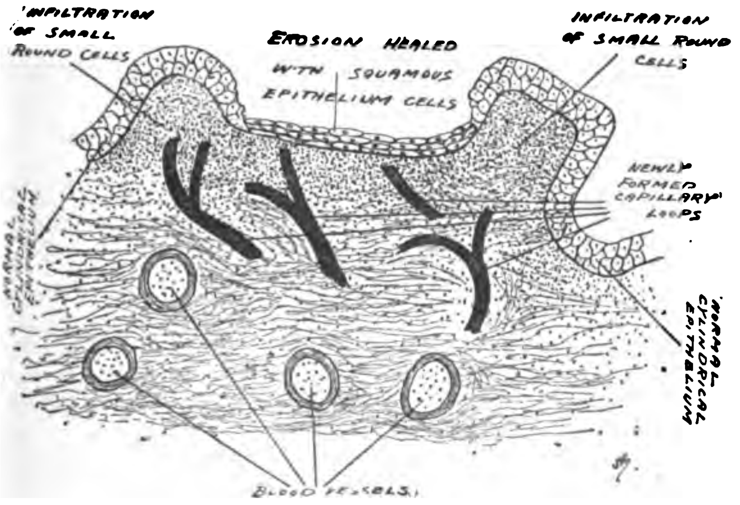

INFILTRATION OF SMALL ROUND CELLS
EROSION HEALED WITH SQUAMOUS EPITHELIUM CELLS
INFILTRATION OF SMALL ROUND CELLS
NEWLY FORMED CAPILLARY LOOPS
NORMAL CYLINDRICAL EPITHELIUM
NORMAL CYLINDRICAL EPITHELIUM
BLOOD VESSELS.

Fig. 10.—Diagram of a Section of the Urethra, Representing the Histological Changes in the Formation of a Granular Patch in Chronic Urethritis.

These "granular patches" resemble an ulcer in any part of the body after it has become covered with luxuriant florid granulations, which are composed purely of capillary loops, having no tendency to cicatrize and which are easily broken down and destroyed by slight force.

In other cases the mucous membrane is not eroded and there are no granular patches present. Instead of a loss of substance there is simply swelling, congestion, and œdema of the mucous membrane, in scattered patches, occasioned by its being in a condition of chronic inflammation and infiltrated with leucocytes.

These superficial changes in the mucous membrane occasion a continuous gleety discharge until they are healed.

Final healing of the lesions is brought about as follows:—

When the small round-celled infiltration is first deposited, it is soft and succulent, and while in this state it may disappear, entirely or in part, by a process of *absorption.*

If absorption does not take place, the small, round, infiltrating cells become organized, and are replaced by true fibrous connective tissue of a low grade, which goes on to *contraction.*

In a case where the infiltration was of the *superficial,* or *mucous, form,* involving only the mucous membrane and surrounding the glands, stricture does not follow.

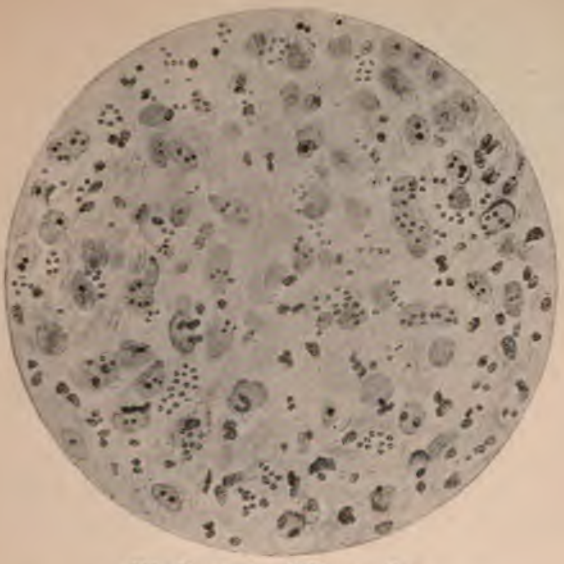
In the *deep* form of infiltration, however, which extends deeply into the periurethral tissues and involves the meshes of the corpus spongiosum extensively, the heavy masses of scar-tissue, into which the infiltration becomes converted, contract, impair the dilatability or may materially decrease the calibre of the urethral canal, and form *stricture.*

After the infiltration which surrounded Morgagni's crypts and Littré's glands has been converted into scar-tissue, its subsequent contraction squeezes the walls together; so that the glands are compressed and obliterated.

The granulations, which have formed upon the erosions, consist simply of capillary blood-vessels, which have been given off from the submucous vessels and have penetrated the infiltration in an upward direction. After the formation of scar-tissue its contraction squeezes the capillaries together and destroys them, and the granulations disappear as a result of strangulation.

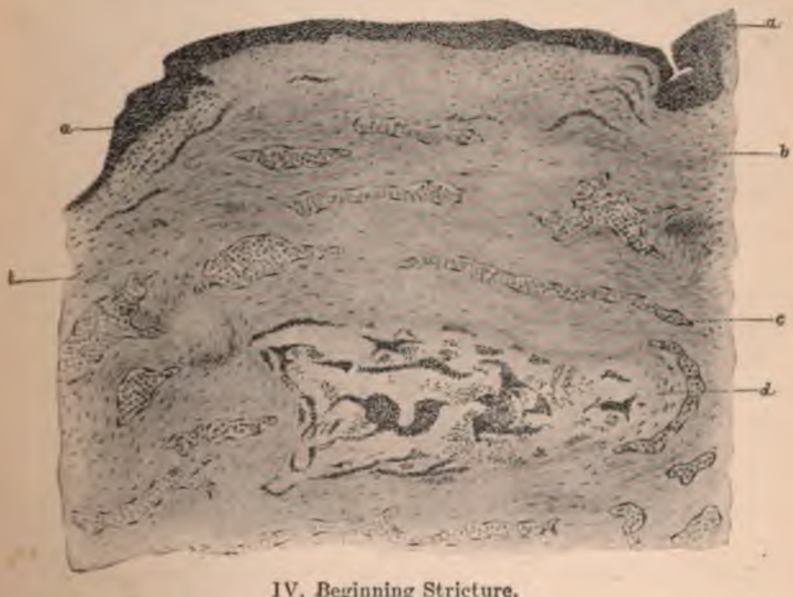
The erosions become covered, not with the normal cylindrical epithelium of the healthy portions of the mucous membrane, but by many layers of squamous epithelium.

The changes wrought by the conversion and contraction of the



III. Gonorrhœal Rheumatism.

Synovial membrane infiltrated with numerous intracellular gonococci.



IV. Beginning Stricture.

a, Squamous epithelium in many layers.
b, Contracted connective tissue.
c, Contracted meshes of the corpus spongiosum.
d, Remains of Littré's gland, obliterated through contraction of the periglandular and interstitial connective tissue.

(From "Die Syphilis und die Venerischen Krankheiten," von Dr. Ernest Finger.)

scar-tissue require from two to ten years for their completion, and they do not proceed with a uniform degree of rapidity; so that, on examining a case, all gradations of the process may often be seen at the same time.

SYMPTOMS.

There is an absence of any marked subjective symptoms; there may be at most an occasional tickling at the meatus.

The *discharge* from the urethra is muco-purulent, thin, and scanty, and is often so slight that there is only a drop in the morning or a sticking together of the lips of the meatus.

A common feature of chronic urethritis is the *exacerbations* which are constantly occurring. The patient develops a profuse purulent discharge, which is checked very promptly by treatment.

As a result of various indiscretions, an acute inflammation is set up in the damaged portions of the urethra, and the discharge which is produced in them occasions a *reinfection* of healthy portions of the canal, as it passes over them.

When a considerable extent of surface of the mucous membrane is involved in the inflammatory process, if the patient passes his water into two glasses, the first glass is *turbid* from the quantity of pus washed out from the canal. On microscopic examination the discharge is found to be composed of pus-cells, containing gonococci in profusion, desquamated epithelial cells, and mucus from the crypts and follicles. After the inflammation is *localized*, and exists only in spots, the urine in the first glass is no longer turbid, but shows a few shreds floating in *clear* urine.

The presence of *shreds* always indicates that at some point along the urethra the mucous membrane is diseased, and a shred is simply the secretion, which forms a scab on the surface, and is washed off by the stream of urine. The form of lesion may be an erosion or granular patch or a chronic catarrh of the mucous membrane lying over an infiltration.

Microscopic examination shows the *composition* of shreds to be pus-cells, which may or may not contain gonococci, and desquamated epithelium, held together by a quantity of mucus.

In *shape* shreds present themselves as heavy flakes; long, slender filaments; tadpole-shaped bodies, or small granules. The heavy shreds always contain pus, and sink to the bottom, while the light filaments are composed entirely of squamous epithelial cells and float. The point of practical clinical importance to determine is whether the

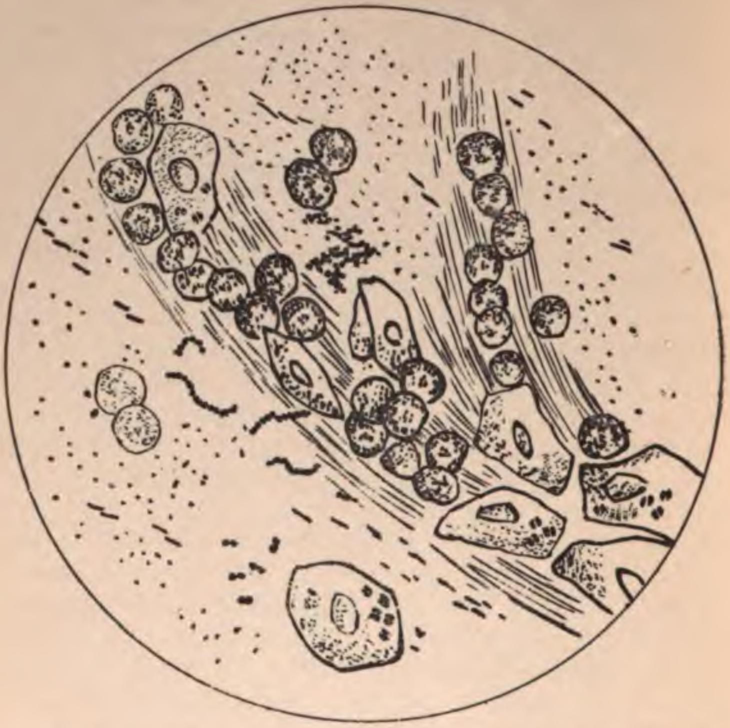


Fig. 11.—Shred from a case of Gonorrhœa of long standing. Mixed Infection has occurred. The specimen shows desquamated Squamous Epithelial cells, with Gonococci on their surfaces, Pus-cells, Staphylococci, and Streptococci arranged in chains.

shreds are made up of pus-cells containing gonococci, or whether they are composed of squamous epithelium alone, desquamated from the healed surface of a former lesion.

DIAGNOSIS.

The points to determine in making the diagnosis of the conditions in chronic anterior urethritis are:—

(*a*) Whether a considerable surface of the urethral mucous membrane is involved in the inflammatory process, and secreting pus freely. When this is the case it is indicated by a *turbid*, cloudy appearance of the first glass of urine, on making the two-glass test. Or (*b*) Whether the inflammation is no longer general, but limited to *localized areas*. In the latter condition the first glass of urine will contain *shreds* floating in *clear* urine.

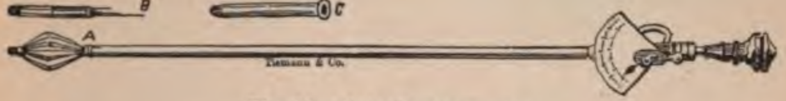


Fig. 12.—Otis Urethrometer.

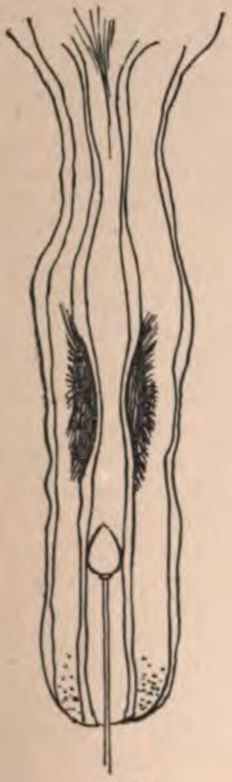


Fig. 13.

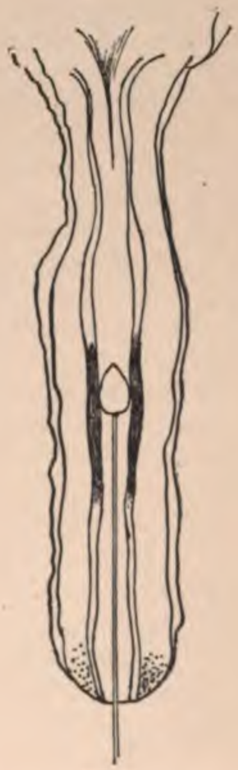


Fig. 14.

Fig. 13.—Diagram showing method of detecting Deep Infiltration, in Chronic Urethritis, with Bougie à Boule or Urethrometer.

Fig. 14.—Diagram showing impossibility of recognizing Superficial Infiltration, involving Mucous Membrane alone, by means of Bougie à Boule or Urethrometer.

It is equally important to ascertain if:—

(*c*) The inflammatory process is *superficial*; that is, limited to the mucous membrane and glands, or if:—

(*d*) The infiltration has involved the meshes of the corpus spongiosum, and commencing stricture is present. The instruments useful in settling points *c* and *d* are: (1) the Otis urethrometer, (2) the bulbous bougie, and (3) the endoscope.

Otis Urethrometer.—*Method of Using.*—The point of *greatest dilatability* of the normal urethra is at the bulb, and on withdrawing the urethrometer we find that the dilatability of the urethra is diminished *gradually* toward the meatus, except at the fossa navicularis. When a *deep* infiltration is present the dilatability of the urethra is diminished *abruptly*, but the urethral canal is freely dilatable both *before* and *behind* the infiltrated point.

On the other hand, *superficial* infiltrations involving only the mucous membrane do not extend into the deeper submucous tissues or meshes of corpus spongiosum and do not interfere with the dilatability of the urethral canal.

It is important to recognize deep infiltrations, while they are still soft and recent and before they have been converted with scar-tissue, so as to bring about their *absorption* and prevent the formation of stricture.

The bulbous bougie, preferably the flexible variety, may be used for the same purpose, but is better adapted to recognizing infiltrations which have been transformed into scar-tissue and begun to contract.

TREATMENT.

In the cases of chronic urethritis of the **superficial variety**—that is, when the diseased condition is limited to the mucous membrane, and does not affect the deeper tissues—the indication for treatment is to bring the inflammatory process to an end and promote the formation of squamous epithelium to cover the erosions. These indications are fulfilled by the local application of astringent and antiseptic solutions. When **general catarrh** of the mucous membrane is present, as indicated by turbidity of the first glass of urine, the patient may inject his urethra with an ordinary gonorrhœa syringe, and gradually increase the strength of the injections. (For formulæ see "Gonorrhœa.") It is preferable, however, to use an *irrigator*, which has the advantage of distending the folds of mucous membrane and insuring a thorough contact of the solution with its entire surface.

A soft-rubber catheter, attached to a large-sized hard-rubber syringe holding 4 ounces, carried down into the bulbous urethra, may be used, but is not as effective as the irrigator.

The best solution to use is the nitrate of silver, beginning with 1 in 5000 and increasing the strength to 1 in 1000.

Permanganate of potash takes the second place as a curative agent, and should be used in the strength of 1 in 6000 or 3000 at the beginning and gradually increased to 1 in 1500.

In cases where no micro-organisms are present and a simple astringent is called for, Ultzmann's solution may be used:—

℞ Zinci sulphatis,	
Pulvis aluminis	aa gr. xij.
Acidi carbolici,	
Glycerini	aa ♏xij.
Distilled water	q. s. ad f℥ss.

Sig.: Use half an ounce to a pint of water, and increase to one ounce to a pint.

All these solutions should be warm, and the irrigations should be made, in general, every second day, although occasionally they may be of use every day.

Isolated Foci.—After the disease has become older and the inflammation of a considerable surface of the mucous membrane has subsided, it still lingers in spots in the canal. It is no longer general, but localized to particular areas, and on examining the urine the first glass, instead of being turbid from pus, is *clear*, but contains *clap-shreds*, or filaments, floating in it. Many of the localized cases heal under irrigation, but in those cases which prove obstinate *concentrated solutions* must be applied directly to the localized diseased spots by means of (*a*) instillations with a Guyon or Ultzmann syringe, (*b*) Ultzmann's brush apparatus, or (*c*) the endoscope in very exceptional cases.

Instillations.—By means of Guyon's or Ultzmann's syringe concentrated solutions of nitrate of silver can be deposited, drop by drop, along the whole length of the urethra, from the vesical sphincter to the meatus, thus bringing the medicament in contact with healthy and diseased portions alike.

It is very exceptional for the diseased foci to be so isolated that they can be treated in any other way, even through the endoscope.

The indication for the use of instillations of nitrate of silver is considered to be the *presence of clap-shreds floating in clear urine.*

In a case coming under treatment, however, for the first time, instillations should never be used until the effect of irrigations has been tried, for the treatment of chronic gonorrhœa is founded upon the principle of beginning with mild applications and gradually proceeding to the use of stronger and more irritating measures.

Another point to bear in mind is the fact that the irritation caused by the application of concentrated and caustic solutions may in itself prolong the inflammation and prevent the recovery. So that it is always desirable, in a case which has been energetically treated, to interrupt, for two or three weeks, all local applications, in order to allow the irritation caused by them to subside.

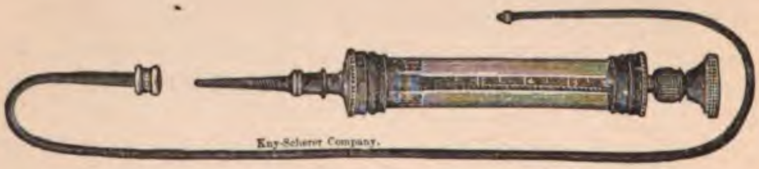


Fig. 15.—Guyon's Syringe.

In beginning the treatment with instillations, 15 drops of a 2-grain-to-the-ounce solution of nitrate of silver should be used, which causes some reaction, burning on urination and increased secretion, which lasts for twenty-four hours and then subsides.

In every case where the presence of posterior urethritis is suspected, the point of the syringe should be carried beyond the cut-off muscle and a few drops of the solution deposited along the posterior urethra; and as the syringe is withdrawn the anterior urethra is "etched," a drop at a time, along its entire length.

The instillations should be made every two days and used two, three, or four times, or, in fact, as long as a diminution in the shreds is noted. By this time the urethra has become accustomed to the irritation of the solution, and its strength must be increased to 5 grains to the ounce. The strength of the solutions are gradually increased in this way until the patient is well or until a strength of 25 grains to the ounce is attained.

The patient may be allowed to use a mild astringent injection, upon the days when no instillation is made.

During the course of the treatment *exacerbations*, accompanied by vesical tenesmus, free suppuration, and turbidity of both glasses of urine, occur at times. When these happen, the instillations must, of course, be suspended and either sandal-wood oil or salicylate of soda given by the mouth, or, if the exacerbation is not very severe, the case may be treated by irrigations until the urine is again free from pus, when the instillations may be resumed.

Cases of chronic anterior urethritis which are several years old, and where the pathological changes of erosion and granulation formation are very extensive and the gonococci have entirely disappeared from the tissues, sometimes resist the nitrate-of-silver applications. In such cases Finger recommends instillations of sulphate of copper, beginning with 25 grains to the ounce and increasing to 50, 75, and 100 grains. This is only to be used, however, after the nitrate of silver is found to be ineffective.

The first instillation of sulphate of copper is said either to cause a diminution in the number of shreds or else, in the event of gonococci still being in the tissues, to occasion a profuse purulent discharge. Hence it is that the presence of gonococci is considered a contraindication to the sulphate-of-copper treatment, and, in the event of gonococci being still present, a reversion to the nitrate of silver is again in order.

Ultzmann's Brush Apparatus.—A few years ago a favorite method of treating chronic anterior urethritis was by means of the brush apparatus, but of late years the treatment by irrigations and instillations has largely supplanted it.

It is usually the case that when the bulb is affected the remainder of the mucous membrane is by no means healthy. If the entire anterior urethra is brushed over, by a combined rotary and withdrawing motion of the brush, with a solution of nitrate of silver from 15 to 25 grains to the ounce in strength and examined immediately afterward with the endoscope, the diseased spots will be seen to be colored a whitish gray, while the healthy portions of mucous membrane will appear unaltered by the nitrate of silver. In this way the growth of epithelium is stimulated over the eroded spots. The anterior urethra should be brushed over every second day or even every day. In obstinate cases of long standing sulphate-of-copper solutions may be used in the same way.

Treatment with the endoscope is only applicable to a few cases, viz.: those in which the disease process is exceedingly circumscribed, and these are exceptional in point of frequency. Examination with the endoscope determines that the urethra is healthy in the main, but that certain isolated spots are diseased. If the crypts and follicles are affected, their walls are elevated and of a dark-red color (glandular and periglandular urethritis), or there may be one or two patches of granulation in the urethra. In either case we can apply a strongly concentrated solution directly upon the diseased spots, through an endoscope, by means of a cotton swab, without its coming in contact with the healthy mucous membrane.

Nitrate of silver in solution as high as 20 per cent. or copper sulphate up to 10 per cent. can be used. Destruction of the diseased glands with a galvano-caustic is necessary only in cases of extreme rarity.

In general, the value of endoscopic treatment is limited, as there are very few cases where the pathological changes are confined to one or two isolated spots, and in others the cause of the continuance of the persistent secretion are changes *underneath* the surface of the mucous membrane, which are not recognizable by inspection.

The **deep form** of chronic anterior urethritis in which, in addition to disease of the mucous membrane, an *infiltration* composed of small round cells is present in the *submucous tissues,* even extending into the meshes of the corpus spongiosum, must be treated on different lines from the superficial variety of urethritis. In these cases the infiltration lying underneath the mucous membrane cannot be reached by applying astringent or bactericidal solutions to its surface, and, while the secretion may be held temporarily in check, an exacerbation occurs on the slightest provocation.

The indications for treatment are:—

I. To promote the absorption of the infiltration and restore the elasticity of the urethral wall.

II. To subdue the existing superficial inflammation in the mucous membrane and glands.

III. To destroy the gonococci, which are harbored in the substance of the infiltration and in the urethral glands.

The first indication—that is, the promotion of the absorption of the **infiltration**—is met by the passage of a **steel sound** large enough to distend the urethra fully and put the ring of infiltration upon the stretch.

The therapeutic effects of the passage of sounds are:—

I. To allay urethral hyperæsthesia. The passage of the sound blunts the extreme sensitiveness of the nerve-filaments and abolishes any spasmodic contractions of the muscular fibres which may be present.

II. The infiltration lying beneath the mucous membrane renders it rigid and impairs its elasticity. A sound large enough to distend the urethra stretches the infiltration and causes small tears in its substance beneath the mucous membrane. A traumatic inflammation, with increased vascularization, results from these tears, and absorption is stimulated.

III. The passage of a sound expresses and squeezes out the contents of the suppurating urethral crypts and follicles.

IV. The stretching of the urethral walls by the sound breaks down granulations and stimulates the formation of epithelium upon eroded spots.

In order to meet these indications it is necessary to use a sound of *large* calibre, which will fully distend and stretch the urethral canal.

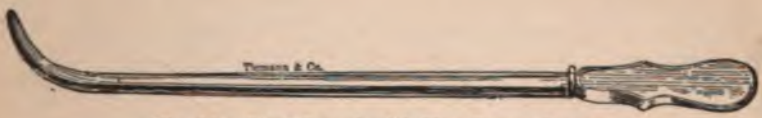


Fig. 16.—Steel Sound with Van Buren Curve.

The sound should not be passed too frequently. In cases of soft and recent infiltration the intervals may be from two to four days, always waiting until the reaction following has subsided. In cases of hard, organized infiltration the intervals should be longer: from five to eight days.

If the *meatus* is too narrow to admit a sound of sufficient size, it should be divided upon the floor.

There are, however, certain cases where it is undesirable to enlarge the meatus, as, for instance, in hypospadias, and, again, there are other cases where the urethra is so capacious that a No. 30 French sound will lie in it loosely without stretching the walls or compressing the infiltration. In these cases recourse may be had to the **Oberlaender dilator.**

The action of the dilator is to tear apart the infiltration underneath the mucous membrane, which remains intact without being wounded. This is an important feature of dilatation, since any fresh wound of the mucous membrane would open up a passage for renewed infection with micro-organisms.

Oberlaender claims that a fresh inflammation starts up from the tears in the infiltration, but the increased vascularization occasions its absorption.

The dilatation should be very gradual,—one or two numbers at a sitting,—and should not be performed oftener than once a week, and care should be taken not to lacerate the mucous membrane. If this accident should occur, it will be announced by hæmorrhage from the meatus.

It makes no difference, as far as treatment is concerned, whether the submucoid round-celled infiltration is soft and recent or whether it has been transformed into scar-tissue. The indications in either case are, by dilatation and pressure, to promote its absorption. Cases which are quite recent—that is, less than from two to six months old—are made worse by attempts at dilatation. Cases in which a considerable surface of mucous membrane is involved are unsuitable for dilatation, until the catarrh has been checked by irrigations and the superficial process is localized to a few spots in the urethra, as denoted by shreds floating in clear urine.

The second and third indications—which are to cure the inflammation in the mucous membrane and glands and destroy the gonococci—have been already considered under the treatment of the superficial form of urethritis, and the measures adapted to these ends should be combined with the dilatation.

It is always desirable to use irrigations after dilating with a sound or dilator. The folds of the mucous membrane are smoothed out by the pressure of the sound and the solution comes in contact with the whole surface. If small tears have occurred in the mucous membrane from stretching, the irrigating fluid seals them up and prevents infection.

Instillations of concentrated solutions are not admissible upon the same day of the dilatation, but should only be used two or three days later.

CHRONIC POSTERIOR URETHRITIS.

The posterior urethra is involved in about 80 per cent. of all cases of acute gonorrhœa. In many of these the disease never becomes chronic, but, when it does, the posterior urethra remains inflamed quite as often as the anterior.

Chronic posterior urethritis may exist alone, the inflammation having run its course and ended in the anterior part of the canal, but we frequently find a chronic inflammation of both anterior and posterior portions of the urethra, at the same time.

Acute posterior urethritis is almost invariably caused by gonorrhœa, but a *chronic* inflammation can be occasioned in other ways. Any cause which tends to produce a prolonged state of *congestion* in the posterior urethra which is oft repeated will, in time, lead to the establishment of a condition of *inflammation* in the mucous membrane and hyperplasia of the submucous tissues.

The causes which are usually responsible for these conditions are excessive sexual intercourse or sexual abuses, such as masturbation or coitus reservatus (withdrawal).

For all practical purposes, the symptoms and treatment of chronic posterior urethritis may be considered together, without regard to its etiology.

PATHOLOGY.

On account of the abundant supply of glands and follicles and the thickness and vascularity of the mucous membrane the pus-formation is apt to linger in the posterior urethra for years, and is very apt to attack the prostate and seminal vesicles.

The histological changes are substantially the same as in chronic anterior urethritis.

The mucous membrane is in a state of chronic inflammation, with desquamation of its epithelium, and the submucous tissues are the seat of a small round-celled infiltration, which also surrounds the mucous crypts. The infiltration, in time, becomes converted into scar-tissue and the glands are obliterated by its pressure. The infiltration, however, is not transformed into distinct *bands* of scar-tissue, such as form strictures in the anterior urethra, but there is simply a *general condensation* or *fibrous hardening* of the periurethral tissues.

The sclerosis of the submucous tissue does not materially narrow the calibre of the urethra, and, consequently, stricture never occurs in the posterior urethra, except from traumatic origin.

The *verumontanum*, or *colliculus seminalis*, is always affected in chronic posterior urethritis. It is enlarged, the mucous membrane is bluish in color and softened, and the natural sensitiveness is aggravated to a high degree. This structure is the point most highly supplied with nervous filaments in the urethra, and, on account of its increased receptive influence to painful impressions, when the submucous infiltration begins to contract it compresses these nerves and occasions marked reflex disturbances.

The symptoms are often *mental*, and take the form of hypochondria, depression, irritability, and inability for sustained mental effort, or may be *neuralgic* in character and referred to distant or associated organs.

DIAGNOSIS.

The two-glass urine test is only applicable to cases where there is a considerable amount of pus-formation. In the following instances the posterior urethra may be chronically inflamed and the second glass of urine will not be discolored:—

(*a*) When such a *small quantity* of pus is secreted that it does not flow back and discolor the urine in the bladder.

(*b*) When the stream of urine is feeble in force and not sufficient to wash out the mucous plugs from the crypts and follicles. Contraction of the muscular structures surrounding the urethra is necessary to accomplish their emptying.

(*c*) The prostatic crypts and seminal vesicles may be chronically inflamed and yet the pus formed does not flow out freely enough to appear in the urine *unless* direct pressure is made upon those organs by means of the finger in the rectum.

The **Jadassohn-Van Zeissl method** is useful in overcoming objections *a* and *b*. The *technique* is as follows:—

The *anterior* urethra is irrigated by means of a catheter attached to a syringe or irrigator, which is carried down to the cut-off muscle. After the anterior urethra has been thoroughly cleansed the patient urinates in a glass, and the urine contains the pus or shreds washed out from the posterior urethra. The patient then passes the remainder of his urine into another glass, which represents the condition of the urine which had accumulated in the bladder.

After both anterior and posterior urethras have been cleansed of accumulated secretions by washing out and urinating, the secretions from the prostatic follicles and seminal vesicles should be collected by means of **Jadassohn's expression urine test.** By means of a finger in the rectum a pressure or massage is exerted upon the prostate gland, and the seminal vesicles and their contents are squeezed out into the urethra. The patient then urinates and washes out the expressed secretions into a glass. The urine in the glass containing the secretions expressed from the prostate and vesicles is called the *expression urine.*

In examining cases of chronic posterior urethritis we should always pay particular attention to the condition of the *seminal vesicles* and *prostatic follicles.* These organs are very liable to be affected by an extension of the gonorrhœal inflammation from the urethra, and when once attacked the gonococci are very likely to remain in them and continue to propagate for months and, indeed in some cases, for years.

SYMPTOMS.

If the posterior urethra alone is diseased, there is an *absence* of purulent discharge from the meatus.

In the later stages of the disease there is but very slight pus-formation, simply a congestion of the mucous membrane, with an infiltration and condensation of the submucous tissues. But in the early stages and in exacerbations, the pus-formation may be in considerable quantity, and will be easily shown by making the two-glass urine test.

On account of the chronic inflammation, the posterior urethra is always in a state of exaggerated sensitiveness, and the necessity for **frequent urination** is nearly always present. Usually the desire to urinate is so *urgent* that the patient cannot wait, but must respond at once to the call, or the urine escapes and wets his clothing.

Sexual symptoms are nearly always prominent. The sexual appetite is disturbed. There is either no inclination for coitus and, if indulged in, a condition of general nervous depression follows, or else there may be a constant desire for sexual intercourse, which is not satisfied by indulgence.

The act of coitus is not satisfactorily performed. Ejaculation occurs prematurely on account of the irritable condition of the posterior urethra, and for the same reason *seminal emissions,* or pollutions, occur at night during sleep, more frequently than is natural, and in some cases the seminal discharges may be stained with blood, which is derived either from the congested posterior urethra or else from an inflamed condition of the interior of the seminal vesicles.

Mental symptoms are a striking feature of most cases of posterior urethritis. The patients are hypochondriacal, they suffer from depression of mind, and are low-spirited, melancholy, and despondent, and in extreme cases may have suicidal impulses. In this frame of mind they fall an easy prey to quacks and charlatans, whose advertisements guaranteeing to "restore lost manhood and relieve the evils attendant upon the errors of youth," appear in the columns of the daily papers.

TREATMENT.

In chronic inflammation of the posterior urethra resulting from sexual excesses or abuses, the anterior urethra is not involved; but in posterior urethritis caused by gonorrhœa the anterior urethra is generally affected as well.

For purposes of treatment it is well to divide the cases of posterior urethritis into two groups:—

(a) Superficial, in which the mucous membrane and glands alone are involved in the inflammatory process.

(b) Deep form, in which, in addition to the inflammation in the mucous membrane, there is an *infiltration* in the deeper tissues.

The small round-celled infiltration is deposited here and ultimately is converted into scar-tissue. It does not contract and form fibrous bands, but merely produces a general condensation and hardening of the submucous tissue.

In the *superficial* form, where there is a considerable amount of pus-formation, **irrigation** by means of an irrigator or syringe and soft-rubber catheter introduced beyond the cut-off muscle, using nitrate-of-silver or permanganate-of-potash solution, will generally check the secretion. After the suppuration has lessened **instillations** *with Ultzmann's syringe,* carried behind the cut-off muscle into the posterior urethra, of 15 drops of a nitrate-of-silver solution, beginning with 2 grains to the ounce and increasing as directed in the treatment of "Chronic Anterior Urethritis," usually causes a prompt disappearance of the remaining secretion and shreds. If it is desirable to medicate the posterior urethra without having the nitrate-of-silver solution come in contact with the interior of the bladder, it is well to make the instillation with the bladder full of urine. In that event any of the solution which flows back into the bladder is neutralized by the salts of the urine.

If, on the other hand, we wish to affect the base of the bladder as well as the posterior urethra, the bladder should be emptied of urine before making an instillation.

In treating the *deep* form of chronic posterior urethritis the *indications* are:—

I. To cure the inflammation in the mucous membrane.

II. To produce absorption of the deep-lying infiltration.

To accomplish these objects it is necessary to employ, in addition to the irrigation or instillation, the regular passage of *sounds*. Forcible dilatation or tearing apart of the tissues is harmful, and we should proceed with the utmost gentleness and caution in the manipulation of sounds in this region. The sound, of course, should never be passed until the free suppuration has ceased and there are only very chronic and indolent inflammatory residua remaining, on account of the danger of increasing the inflammation or of causing epididymitis.

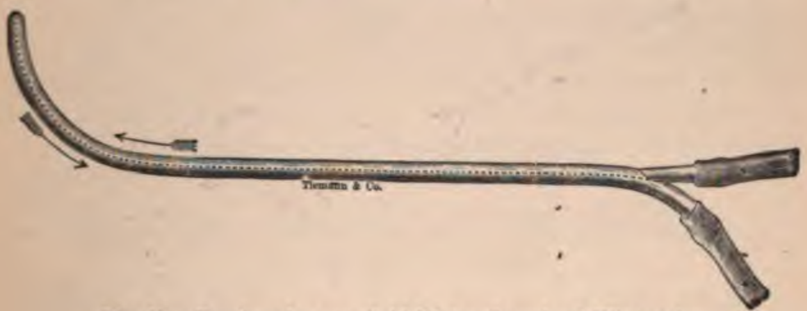


Fig. 17.—Psychrophor, or Cold-Water Sound, of Winternitz.

The Benique sound is particularly adapted to the posterior urethra, on account of its shape, which is similar to that which a soft catheter assumes when it lies in the bladder and urethra. The weight of the Benique sound has some advantage, as it produces a certain amount of compression and so stimulates absorption of the infiltration, besides emptying out the crypts and follicles.

The cases of chronic posterior urethritis which require the use of *Kollmann's posterior dilator* are exceptional in frequency. When the dilator is used in the posterior urethra great care should be exercised not to dilate too rapidly and so lacerate the tissues or excite epididymitis, as the tolerance to instrumentation is far less in the posterior urethra than in the anterior.

The psychrophor, or cold-water sound, made preferably with the

Benique curve, is found to be of more benefit than the ordinary steel sound, in the cases which develop a chronic sexual neurasthenia or have local symptoms pointing to excessive irritability of the posterior urethra, such as unduly frequent seminal emissions.

The psychrophor should be used every second day for ten or twenty minutes. The effect of the cold is to diminish the hypersensitiveness of the verumontanum, and the pressure of the sound acts beneficially in promoting absorption.

In every case of chronic posterior urethritis the condition of the seminal vesicles should be investigated by rectal examination. It is useless to attempt to cure an inflamed posterior urethra when a pair of inflamed seminal vesicles are discharging a quantity of gonorrhœal pus into the urethra every few days and causing an *exacerbation.* Many cases of relapsing posterior urethritis will get permanently well through a systematic stripping of the seminal vesicles, when everything else has been tried in vain.

At the same time the prostate should not be overlooked, for a follicular prostatitis is often present as a complication, and should be treated by massage through the rectum, in order to empty out the contents of the inflamed and dilated prostatic crypts.

SUMMARY OF TREATMENT OF CHRONIC ANTERIOR AND POSTERIOR URETHRITIS.

In the great majority of cases of chronic urethritis a *systematic* and regular course of *dilatations*, with sounds or Oberlaender's dilator accompanied by copious *irrigations* of weak astringent solutions, will be more successful than any other plan of treatment. Before beginning dilatation the inflammation of the mucous membrane should no longer be *general*, but confined to localized areas.

When the inflammation is general, the urine passed in a glass is turbid and cloudy from admixture with pus, but the localization of the inflammation to isolated spots is indicated by *shreds* floating in clear urine.

After dilatation and irrigations have been carried out for some time and the patient is not cured, as shown by persistence of morning drop and shreds, concentrated solution of nitrate of silver may be applied directly to the inflamed areas by means of:—

(*a*) Ultzmann's brush apparatus.

(*b*) Guyon's or Ultzmann's syringe.

(*c*) The endoscope.

In every case of chronic posterior urethritis the condition of the seminal vesicles and prostate should be ascertained, and, if diseased, they should be treated by stripping or massage through the rectum.

PROGNOSIS OF CHRONIC ANTERIOR AND POSTERIOR URETHRITIS.

The duration of the disease is always protracted, and requires great patience on the part of physician and patient.

The test as to when the patient is cured is the *permanent absence of pus-cells* and *gonococci in the urethral secretions.*

When all discharge has ceased from the anterior urethra, in order to get material for microscopic examination it is necessary to inject a syringeful of 2-per-cent. nitrate-of-silver solution into the anterior urethra. A free discharge of pus follows, which ceases in twenty-four hours. If no gonococci are found in the resulting secretion after microscopic examination of several smears, it is safe to conclude that the micro-organisms have all been eliminated from the urethra in front of the cut-off muscle.

The secretions of the prostatic crypts and seminal vesicles should be expressed by the finger in the rectum and examined at the same time. It is from these organs that the chief danger of infection comes after discharge has ceased from the meatus, and they are responsible for the majority of cases of infection of wives and mistresses. In examining the expressed secretions from the prostate and vesicles it is not enough to demand absence of gonococci; we should insist upon an *absence* of *pus-cells,* for if pus-cells are present there may be an occasional gonococcus in a cell which might easily be overlooked.

It is estimated that one-eighth of all the diseases of women are occasioned by gonorrhœal infection attacking the vagina or cavity of the uterus, and thence extending to the Fallopian tubes and ovaries. In view of these facts, a patient who has suffered from chronic gonorrhœa should only be allowed to marry when examination shows:—

I. Absence of gonococci.

II. Absence of pus-cells.

III. Freedom from stricture.

IV. A healthy normal condition of prostate and seminal vesicles.

Certain cases of chronic urethritis suffer from *excess* of *treatment,* and the inflammation is maintained by the irritation produced by the local applications.

After a case has been under treatment for a couple of months, it is always desirable to stop all injections or instillations for ten days in order to make sure that the natural process of recovery is not retarded by overtreatment.

Entire disappearance of *shreds* is not to be looked for. The erosions have been covered with many layers of squamous epithelium, and continuance of desquamation of the upper layers goes on as the new cells are formed in the depths.

The shreds appear as thin filaments which float in the urine, and microscopic examination shows them to be composed of squamous cells alone without containing any pus-corpuscles.

METHOD OF EXAMINING A CASE OF CHRONIC URETHRITIS.

First Day.

History: Take in detail.

I. Inspect pus squeezed from meatus.

II. Examine urethra with bulbous bougie or urethrometer.

Second Day.

III. Wash out shreds and secretion from anterior urethra.

IV. Patient urinates in glass No. 1. No. 1 contains washings from posterior urethra.

V. Examine prostate and seminal vesicles per rectum.

VI. Patient urinates in glass No. 2. No. 2 contains expression urine from prostate and seminal vesicles.

VII. Examine shreds and pus secreted by urethra microscopically.

Third Day.

VIII. Examine urethra with endoscope unless a considerable portion of the mucous membrane is inflamed and secreting pus freely.

URETHROSCOPY.

The use of the urethroscope or endoscope is disappointing in many cases, inasmuch as the diseased processes in the urethra occur chiefly underneath the mucous membrane, and the surface is often but little affected.

It has a field of great usefulness, however, for disclosing and treating diseased processes which are strictly localized to one or two isolated foci, and it is useful in diagnosis and also enables us to observe the effects of treatment by dilatation and irrigation.

There are many varieties of urethroscopes in use, and after using most of them I have come to prefer the simple Klotz tube, illuminated by means of a light reflected with a head-mirror from a powerful central-draft oil-lamp. (The Belgian, Mitrailleuse, or Rochester lamps are suitable.)

The beginner in endoscopy should select the shortest and widest tube which will pass the meatus, doing a preliminary meatotomy if necessary. It is very difficult for even an experienced urethroscopist to see through a tube which is less than No. 24 French in calibre, and as larger tubes are used the examination becomes correspondingly easier.

The tubes which are indispensable are Nos. 24, 26, and 30 French, each four inches long, and Nos. 26 and 28 French, each six inches long. With the short tubes the anterior urethra is examined, and the posterior urethra by means of the long ones.

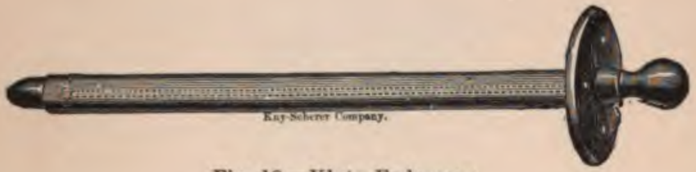


Fig. 18.—Klotz Endoscope.

Normal Appearances of Anterior Urethra.—I. Observe the surface of the funnel-shaped figure which the urethral walls assume beyond the end of the endoscope.

II. The central figure: *i.e.*, appearance presented by the closed lumen of the urethra, which forms the apex of the funnel.

The folds of mucous membrane radiate from the central figure outward toward the periphery. Their thickness and number indicate if the mucous membrane be infiltrated, and are of diagnostic importance. Longitudinal red stripes running toward the central figure are also noted, and indicate a normal uninfiltrated condition of the mucous membrane.

The surface of the mucous membrane is smooth and glistening and with a distinct lustre; its color is ordinarily pale and rosy, but if normally hyperæmic may appear distinctly red or purple, without being diseased.

The openings of *Morgagni's crypts* appear in the roof of the urethra as red specks or small slits as large as a pin's head.

The posterior urethra presents substantially the same appearances as the anterior, except that in addition the *verumontanum* is seen upon the floor of the urethra looking like a fold of mucous membrane.

In exceptional cases the ejaculatory ducts can be seen as little dots alongside the verumontanum.

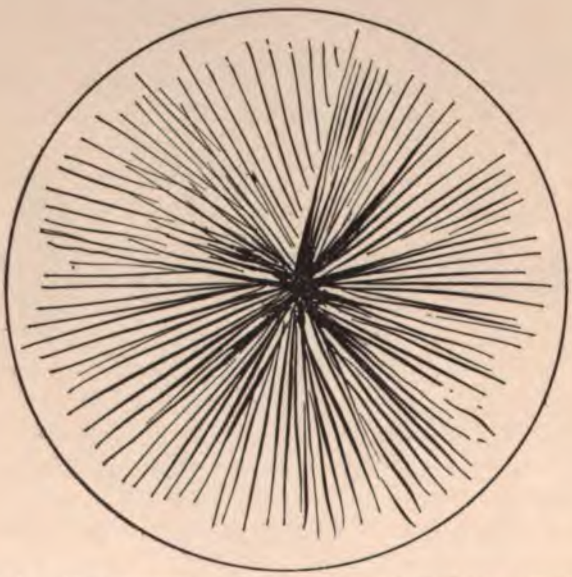


Fig. 19.—Urethroscopic picture of a Normal Urethra, showing a multitude of fine folds and small Central Figure.

Pathological Changes. — Chronic urethritis is divided into two forms:—

(*a*) Superficial: *i.e.*, affecting mucous membrane and glands without involving the deep tissues.

(*b*) *Deep form* in which, in *addition* to the involvement of mucous membrane and glands, a round-celled infiltration occurs in the *deeper lying submucous* tissues, which is ultimately converted into fibrillated connective tissue.

The new fibrous tissue causes a *rigidity* of the urethra, and, as it contracts, produces a narrowing of the urethral calibre, or stricture, and also destroys, by compression, the urethral glands which it surrounds.

On viewing a case of the *superficial* form of chronic urethritis endoscopically, we note a swollen, œdematous, and puffy condition of the mucous membrane at the diseased points. The folds, instead of being numerous and fine, are thick and broad.

Attention should be paid to the *lustre* of the mucous membrane.

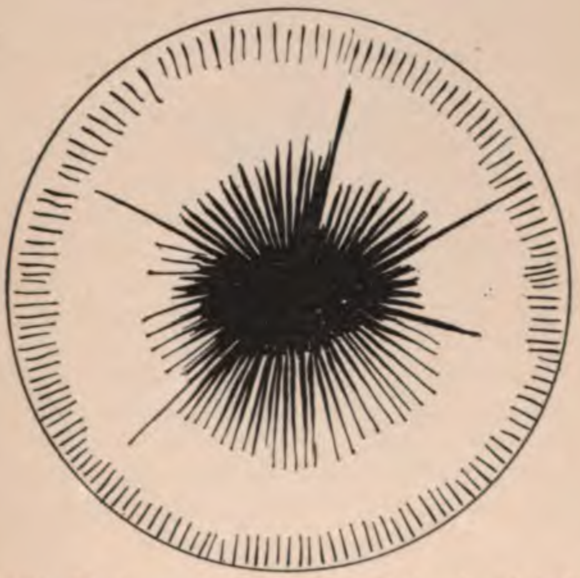


Fig. 20.—Urethroscopic picture of Soft Infiltration of the Mucous and Submucous Tissues. The Central Figure is Wide and Gaping, and the Folds of Thickened Mucous Membrane are Few in Number and Coarse and Broad.

The epithelial layer forms a smooth transparent covering with a distinct uniform lustre, which is *increased* when the mucous membrane is congested and swollen, and *diminished* when it is infiltrated or when the epithelium is desquamated.

Erosions occur in consequence of the desquamation of epithelium, which, when extensive, uncovers the orifices of Littré's glands. They become visible as small, round, red specks arranged in groups projecting above the floor of the eroded surface. Later in the disease the erosions often become covered by a growth of capillary loops from below, which converts them into beds of *granulations*. These appear of the size of small grains of sand, or may only cause a papillated appearance upon the surface of the mucous membrane, and bleed freely upon the introduction of the endoscopic tube.

Granulations are generally associated with an infiltration of the deeper submucous tissues.

In rare cases silvery-white spots may be observed upon the surface of the mucous membrane, resembling the scales of psoriasis, and hence called by Oberlaender: "Psoriasis of the mucous membrane of the urethra."

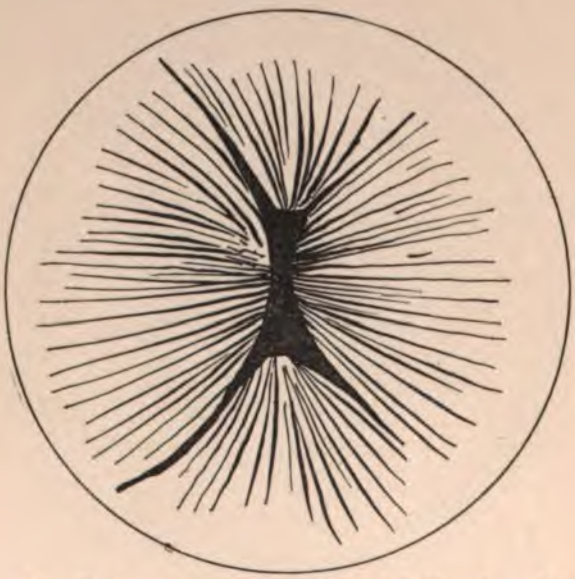


Fig. 21.—Urethroscopic picture of Hard Infiltration of the submucous tissues. The Central Figure is open, gaping, and very irregular in shape.

Morgagni's crypts appear, not singly, but in groups, as small, red points, or depressions. Their openings are swollen and are patulous, and sometimes pus can be seen oozing from them. Later on in the disease, after periglandular infiltration has taken place, these openings gape, and are surrounded by a prominent rim of infiltration.

Upon examining a case of the deep form of chronic urethritis in which the infiltration has become converted into fibrous tissue (hard infiltration—Oberlaender), we note that the *central* figure, instead of being round, is irregular, and gaping widely. The folds of the mucous membrane have disappeared and the color is grayish.

Morgagni's crypts gape widely open, and are often seen surrounded by a ring of inflammation (periglandular infiltration). Littré's glands are sometimes visible, appearing as red specks in a grayish, discolored mucous membrane.

In another class of cases affected with deep infiltration the openings of the glands are not apparent, as they are covered by the epithelium, which has a dry, dull appearance, and desquamates freely in spots.

According to Oberlaender, under treatment by gradual dilatation the restoration of the tissues to their normal condition can be watched endoscopically, and after a chronic urethritis has been entirely healed the appearances are as follow:—

The epithelial layer has grown smooth and possesses its normal lustre and color. It has regained its natural condition of very minute and abundant folds. The infiltration disappears around the glands, although their mouths may still remain patulous and visible. The central figure is round, instead of being gaping and irregular, and cicatrices from former urethrotomies have become smooth and even.

By means of the endoscope we can diagnose those conditions, of rare occurrence, in the urethra, consisting of polypi or papillomata, and we can also distinguish chancre of the urethra and malignant disease.

TREATMENT.

The application of remedies is made to the diseased surface by means of a tampon of cotton wrapped around a stick[1] and introduced through the endoscopic tube. The principal *drugs* in use are: nitrate of silver, from 10 to 100 grains to the ounce; iodine and carbolic acid, equal parts; sulphate of copper, 25, 50, or 100 grains to the ounce; and bichloride of mercury, in 1-per-cent. alcoholic solution.

The intervals of treatment depend upon the amount of reaction; every three days for mild solutions and from five to seven days for strong ones is about the average. After improvement begins intervals should be increased to ten days. The first application should always be mild; 10 grains to the ounce is strong enough to begin with, and it may be increased later if desired.

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[1] The sticks which florists use for tying on to the ends of cut flowers answer the purpose.

In regard to the selection of the appropriate remedy, it may be said in a general way that a diffuse hyperæmia calls for milder solutions of nitrate of silver: 5 or 10 grains to the ounce. Granulations require strong solutions of nitrate of silver, from 50 to 100 grains, or carbolized iodine. For erosions mild solution of nitrate of silver, 5 or 10 grains to the ounce, is the best, while for inflamed glands carbolized iodine answers well.

The prostatic urethra requires the strongest applications of nitrate of silver; but under inspection, if the lesions do not improve, the strength of the solutions can be increased or their character changed, as occasion requires.

Polypi and large warts must be removed by surgical means, and the inflamed glands which do not yield to usual treatment can be obliterated by electrolysis.

With the deep form of urethritis, in addition to applications upon the surface of the mucous membrane, we must endeavor by gradual dilatations, with sounds or dilators, to cause the disappearance of the deep-lying infiltrations.

COMPLICATIONS OF ACUTE GONORRHOEA.

CHAPTER VI.

ACUTE GONORRHŒA.

Balanitis is an inflammation of the mucous membrane of the prepuce and glans penis, and is apt to occur in men with a long foreskin, and particularly in persons of uncleanly habits.

The *treatment* consists in cleanliness, the use of a dusting-powder, and preventing contact of the opposing surfaces of mucous membrane by means of cotton packed between the foreskin and the glans. Occasionally the œdema and swelling are so great that the foreskin cannot be retracted, giving rise to a condition of phimosis.

Phimosis.—This should be treated by prolonged soaking of the penis in hot water and the use of an antiseptic injection thrown in under the foreskin with a flat-billed Taylor syringe. In the event of gangrene threatening or when the swelling and œdema persist, the operation of circumcision or making an incision through the foreskin upon its dorsum is called for. If chancroids are found under the prepuce after operation, they should be cauterized as well as the freshly made wound.

Paraphimosis is that condition in which a long and tight foreskin is caught back behind the glans and cannot be retracted over the head of the penis.

The *treatment* consists in bringing the foreskin back into its proper place by manipulation. If this prove difficult or if the glans looks gangrenous, the constricting band should be incised on the dorsum, which will generally allow reduction to be effected.

Folliculitis consists in suppuration of one of the urethral follicles, with its retention, forming a small abscess, which, if left to itself, opens spontaneously either into the urethra or through the skin.

The *treatment* consists in laying the abscess-cavity open freely, as soon as fluctuation is noticed, evacuating the pus, and allowing it to heal by granulation.

Cowperitis is a suppurative inflammation of Cowper's glands, and should be treated in the same way as folliculitis.

Inguinal adenitis is an inflammatory enlargement of the lymphatic glands in the groin, which is generally present in gonorrhœa. The glands rarely suppurate, but usually undergo resolution.

The *treatment* consists in rest, hot or cold applications, and pressure. If suppuration occur, the glands should be excised.

Chordee is a complication which adds greatly to the discomfort of a patient with gonorrhœa. It is due to the plastic infiltration which takes place into the meshes of the corpus spongiosum, and renders it so rigid and inelastic that it cannot become elongated during erection, but draws on the corpora cavernosa, and bends them down, like the tightened string bends a bow.

Treatment is directed toward preventing these painful erections and allowing the patient to sleep undisturbed. To this end he should use prolonged immersions of the penis in very hot water before going to bed, and should sleep in a cool room, lightly covered. It is better for him to sleep on the side, as the dorsal decubitus favors congestion of the centre of erection in the cord.

A towel tied around the waist with a knot in the middle of the back will assist in this, for if the patient lies on his back the knot will press into the flesh and waken him.

In severe cases these measures are not enough, and we have to administer sedative drugs. Lupulin, gr. xxx-xl at bed-time; bromide of potash in large doses, 30 grains in the afternoon and again at bed-time, or monobromide of camphor in 5-grain doses will sometimes answer, and, when they do not, we must use opium, preferably by suppository.

When the patient wakes with the penis erect and painful, he should immerse both penis and testicles in a basin of hot water, or, if that is not at hand, cold water will answer the same purpose, and he should also empty his bladder.

"Breaking the chordee" leads to violent hæmorrhage and ultimately to severe traumatic stricture.

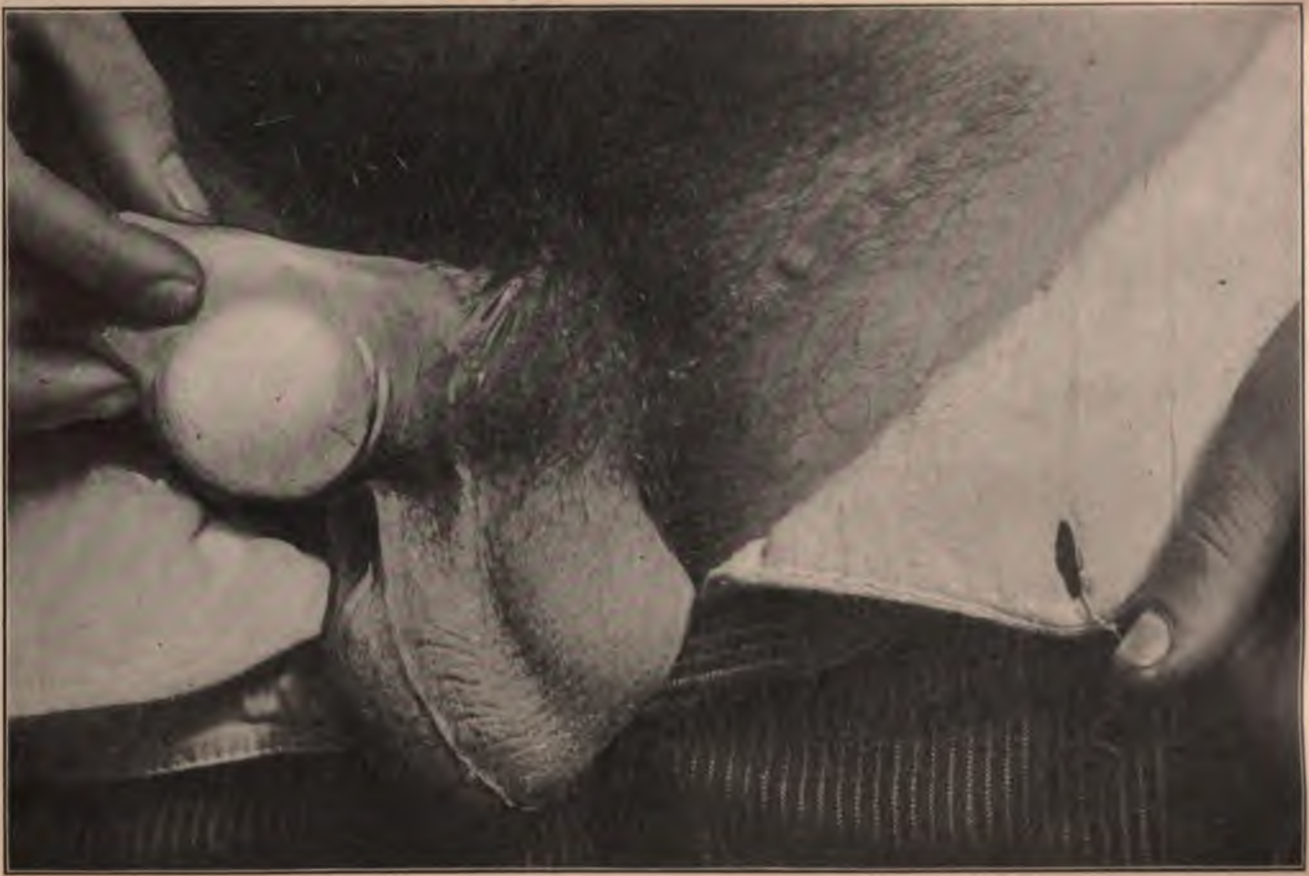

Fig. 22.—Periurethral Abscess, beginning as a Folliculitis. (Author's Case, from the Polhemus Clinic.)

Epididymitis, or inflammation of the head of the testicle, is not a result of metastasis through the blood-vessels or lymph-channels, but is caused by the passage of gonococci from the posterior urethra to the epididymis by way of the seminal vesicles and vas deferens.

The body of the testicle proper is not involved, as a rule, and the inflammation is limited to the epididymis, but the testicle is often *apparently* enlarged on account of its being surrounded by the swollen and inflamed epididymis. Another element which causes the testicle to appear larger than normal is the effusion of serum which takes place into the sac of the tunica vaginalis, and causes hydrocele. This may, in time, be absorbed or remain permanently and increase.

The *symptoms* are always well marked. There is severe pain in the testicle, radiating up into the abdomen. The patient's gait is characteristic: he bends over as he stands and walks with his legs straddling in order to relax the spermatic cord and relieve it from the weight of the enlarged testicle.

The purulent discharge of the gonorrhœa generally ceases at once, and remains absent until the inflammation in the epididymis is better, and then the discharge begins again, only not as profusely as before.

On examining the testicle we find the epididymis enlarged, hard, and tender, and the testicle cannot be readily outlined on account of the effusion of serum into the sac of the tunica vaginalis. The spermatic cord is thickened and very tender. The inflammatory products disappear by resolution and rarely suppurate.

If both epididymes have been affected, a condition of *sterility* may be left, which is permanent. The function of the testicle may be destroyed in three ways:—

I. The most common is the formation of an inflammatory infiltrate in the head of the epididymis, which is not absorbed, but remains and forms a plug, blocking up the efferent duct.

II. An atrophy of the glandular structure of the testicle may occur, probably as a result of inflammatory products in its substance.

III. In very exceptional cases the body of the testicle suppurates and sloughs out, and in this way the organ itself may be entirely destroyed.

Tubercular disease of the testicle occasionally follows a gonorrhœal epididymitis, and is due to the lighting up of a focus of tubercular material, which had been unsuspected and dormant in the epididymis.

Treatment.—If seen within the first few hours, the severity of the inflammation may be lessened by applying three or four leeches along the spermatic cord. The patient should, of course, be put in bed and the testicles supported by means of a Curling handkerchief bandage.

Hot applications are to be preferred rather than the ice-bag, although ice was at one time very popular. While the ice subdues the inflammatory symptoms promptly, its use is very apt to be followed by a hard, tough infiltration in the epididymis, which is never absorbed, but remains, blocking up the epididymis and causing sterility. Another disadvantage of ice is that atrophy of the testicle is more apt to occur in the cases where it has been used.

The hot applications can be used in the form of hot lead-and-opium wash or flaxseed poultices, or a poultice made by splitting a paper of chewing tobacco, dipping it in hot water for a moment, and then applying it around the testicle. In this way the nicotine passes into the circulation and lessens the arterial tension. In cases where a great deal of effusion has taken place into the cavity of the tunica vaginalis, it is desirable to relieve the tension promptly by drawing off the fluid with an aspirating needle.

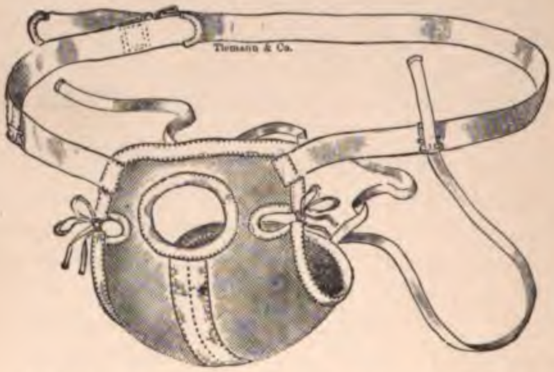

Fig. 23.—Horand-Langlebert Suspensory Bandage.

In cases of epididymitis which are not very severe, the Horand-Langlebert suspensory bandage, lined with a thick pad of cotton-batting, fills the indications of rest, warmth, and suspension, and at the same time permits the patient to walk about without pain.

After the pain of the acute inflammation has subsided Finger advises the constant use of evaporating lotions, which he believes are a surer means of causing the absorption of the infiltration in the epididymis than any other, at this particular stage, although later massage is in order.

After the patient is out of bed and begins to go about, the evaporating lotions may be discontinued, and pressure upon the testicle may be applied by means of firm bandaging used in addition to the suspensory bandage.

Various other plans have been used with a view of promoting absorption of the inflammatory products. A favorite one consisted in strapping the testicle with straps of adhesive plaster, and another which is in common use to-day consists in the application of ointments designed to stimulate absorption. The one which is most commonly employed is:—

℞ Ichthyol .... ʒj.
Lanolin,
Vaselin .... aa ʒss.

M. Sig.: To be applied constantly on lint to testicle.

Iodide of potash given internally is of no use in producing absorption of the inflammatory products.

The *Paquelin cautery* is sometimes used by brushing it lightly over the surface of the skin of the scrotum and burning or searing it very superficially. In the beginning of the disease it has the effect of allaying pain, and later on produces absorption of the inflammatory products.

In order to prevent sterility it is important to promote the absorption of the newly formed tissue in the epididymis.

In recent cases while the infiltrate is soft this may be accomplished by a sort of massage, or kneading, of the infiltration between the thumb and finger; but in cases of long standing, when the infiltration has become hard and dense, all such attempts are unsuccessful.

Gonorrhœal rheumatism is an inflammation of one or more joints occurring in the course of a gonorrhœa and due to the direct action of the gonococcus. The gonococci are carried through the blood-current, and are deposited in various joints, where they set up an inflammation in the synovial membrane lining them.

If the gonococci alone are deposited in the joint, the resulting inflammation causes an excessive secretion of serum, and a simple *hydrarthrosis* results, or the inflammation may attack the synovial sheaths of tendons and the bursæ, occasioning a chronic thickening.

Suppurative inflammations of the joint are due to a mixed infection; in addition to the gonococci, staphylococci and streptococci are the exciting causes.

Clinically we can distinguish three forms of gonorrhœal rheumatism:—

(*a*) *Hydrarthrosis,* which is usually confined to a single joint (monarticular), and is generally the knee.

(*b*) Resembling ordinary rheumatism, since it begins with fever, and several joints are involved.

(*c*) The synovial sheaths of tendons and muscles and the bursæ are attacked and become the seat of chronic inflammatory changes. The joints may be involved or may escape.

The course of all forms is very slow, and recovery is always protracted.

Treatment.—It is of essential importance to treat the gonorrhœa, which almost always affects the posterior urethra or its adnexa.

In the cases which begin with active symptoms—high fever, rapid pulse, and the affection of several joints—salicylate of soda acts well, but in a case which is insidious in its beginning and turns out to be a slow, chronic synovitis, giving rise to a hydrarthrosis, the salicylates are of little use.

Iodide of potash given in increasingly large doses, even as high as 3 or 4 drachms a day, is sometimes of more benefit than anything else. Salol and oil of gaultheria are also sometimes of use.

The *local treatment* is important. The inflamed joint should be put at rest by keeping the patient in bed and applying a light splint to immobilize it. If much heat, redness, and swelling are present, an evaporating lotion or an ice-bag is in order.

After the acute stage has passed off the indications for treatment are:—

I. To produce absorption of the watery effusion in the joint.

The most powerful agent, to this end, is *blistering,* and it should be applied on different parts of the skin over the joint, and used often enough to keep the surface raw for a considerable length of time.

Ichthyol ointment, of 50-per-cent. strength, is sometimes useful as an absorbent. In all chronic cases when the patient walks about *pressure* over the joint by means of a rubber bandage should be applied, and this may serve as a substitute for blistering when the amount of fluid is slight.

When in spite of treatment the fluid does not disappear, it may be necessary to aspirate the joint, and draw off the fluid and irrigate its cavity with a solution of bichloride of mercury, 1 in 5000. After the effusion of serum has been removed the indication is:—

II. To cause absorption of the inflammatory deposit, which has taken place around bursæ, tendons, and synovial sheaths.

This can often be accomplished by *massage* and the douching or spraying with hot and cold water alternately. Cases selected for this treatment should always be very chronic ones, as much harm would be done to an active inflammation by attempts at passive motion or massage.

INFLAMMATIONS OF THE PROSTATE.

CHAPTER VII.

ACUTE PROSTATITIS.[1]

THE acute inflammations of the prostate occur in three well-marked forms:—

I. Simple acute prostatitis, or *congestion*, which accompanies every case of posterior urethritis. There is merely an intense hyperæmia of the gland, with a distension of all its blood-vessels. The symptoms are not characteristic, and are only those proceeding from the posterior urethritis.

On *rectal examination* the prostate is found to be slightly enlarged, soft, and tender to the touch.

The treatment of this condition simply consists in treating the posterior urethritis.

II. The second form of prostatitis is the *acute follicular prostatitis*, in which one or two prostatic follicles become the seat of an inflammation which is localized to the cavities of the glands.

On *rectal* examination one or two nodules are discernible in the substance of the prostate, which are hard and painful on pressure and which are the inflamed follicles. This condition may terminate in:—

(*a*) *Suppuration*, in which the inflammatory material in the follicles suppurates, and breaks out into the urethra, leaving a small fistulous opening which, in the course of time, closes by granulation.

(*b*) *Resolution*, in which the inflammatory products disappear by a process of absorption.

III. Parenchymatous prostatitis, in which the whole substance of the gland is involved in an inflammatory process. This condition may occur as the result of acute congestion or follicular prostatitis, or may develop independently in the course of a gonorrhœa.

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[1] In the consideration of the acute and chronic forms of prostatitis no reference will be made to the senile hypertrophy of the prostate, which occurs in old men and which is considered later in a separate section.

The congestion and swelling of the gland reaches its height about the seventh day, and may terminate in either: (*a*) resolution; (*b*) suppuration; (*c*) induration.

SYMPTOMS.

The symptoms of parenchymatous prostatitis are well marked. The patient has a good deal of fever, and complains of pain in the perineum and rectum, which is increased by pressure. There is a constant feeling as though a foreign body were in the rectum, which occasions expulsive efforts on the part of the muscles and causes rectal tenesmus.

If the enlargement of the prostate is considerable, it bulges into the rectum, and after defecation the stools are flat and ribbon shaped. If the prostate is enlarged anteriorly, it presses upon the urethra and causes difficulty in micturition or complete retention of urine.

COURSE AND TERMINATIONS OF PARENCHYMATOUS PROSTATITIS.

In the cases which undergo *resolution* there is a gradual improvement in the symptoms. On the other hand, if *suppuration* takes place, an abscess forms in the centre of the gland, and the formation of pus is announced by a throbbing pain in the perineum and chills, followed by fever and sweating. If operative measures are not resorted to, the pus bursts through the capsule of the prostate and the abscess empties itself into (*a*) the urethra, (*b*) the rectum, (*c*) or through the perineum, (*d*) or may take an eccentric course.

The pus has been known to burrow its way through the abdominal cavity and finally empty through the inguinal region, the umbilicus, the sciatic foramen, at the edge of the false ribs, through the space of Retzius, etc.

In favorable cases the fistulous opening may close by granulation, but fæces, urine, or pyogenic germs may easily enter the fistula, and urinary infiltration, septic infection, and pyæmia are not infrequent results. A perforation into the rectum or urethra may leave a permanent fistulous opening, with its attendant annoyances.

In statistics collected by Segond, in 114 cases recovery occurred in 70 and death in 34. The third termination of *induration* is rarer than the two preceding. Suppuration does not occur, and the congestion subsides, but the gland is left in a condition of enlargement and fibrous hardening, which remains permanent.

DIAGNOSIS.

Parenchymatous prostatitis may readily be overlooked, and the case regarded as one of posterior urethritis, which is always present and has similar symptoms, *unless rectal examination is made,* by which the enlargement of the prostate can be easily felt.

TREATMENT.

The indications are:—

I. To prevent suppuration of the gland.

II. To lessen the severity of the posterior urethritis.

The patient is put to bed, sandal-wood oil is administered, and the pain and tenesmus controlled by opium. Locally either an ice-bag or hot poultices are applied to the perineum, a safe guide for the choice between hot and cold applications being the sensation of comfort afforded to the patient.

Continuous irrigation of the rectum with hot water, for half an hour at a time, by means of Kemp's tube is often useful.

If retention of urine should occur, the catheter must be introduced, but only when absolutely necessary, and before catheterizing the urethra should be well irrigated to free it from pus, which might be pushed ahead of the catheter into the bladder.

If great difficulty is experienced in introducing the catheter, it is proper to anæsthetize the patient with ether and leave the catheter tied in the bladder, to obviate the difficulty of reintroduction. In extreme cases aspiration of the bladder above the pubes may be demanded.

As soon as pus forms, the abscess should be immediately evacuated, in order to prevent the pus from bursting through the capsule of the gland, burrowing into the tissues, and causing urinary infiltration and pyæmia or at least a fistula which is slow in healing.

Technique of Operation.—The patient is anæsthetized and a sound introduced through the urethra into the bladder. A semilunar incision is made through the skin of the perineum, curving around the rectum in order to avoid wounding it. The incision is deepened by dissection until the capsule of the gland is reached and opened and the pus evacuated. The wound is packed and allowed to heal by granulation.

Another procedure which is only applicable to those cases where operation has been delayed and the abscess is seen obviously pointing in the perineum is, with the finger in the rectum, as a guide, to thrust a narrow straight bistoury directly into the fluctuating mass, through the skin of the perineum, and evacuate the pus.

CHRONIC PROSTATITIS.

Chronic inflammation of the prostate may originate as the result of an acute attack of prostatitis, particularly the follicular form. It may also occur from the extension of a chronic inflammation from the posterior urethra, which was either gonorrhœal in origin or due to the chronic congestion and inflammation brought about by sexual excesses or abuses.

PATHOLOGICAL ANATOMY.

On examination the prostate is found to be enlarged and soft. The crypts and follicles are always attacked by catarrhal inflammation, the cavities of the glands often contain pus, and the openings of their ducts are always large and patulous.

SYMPTOMS.

As chronic prostatitis is always complicated by chronic posterior urethritis, the symptoms will arise from both conditions, and are as follow:—

(*a*) Frequent and urgent urination.

(*b*) Partial or complete impotence.

(*c*) Mental symptoms, which are grouped under the general term "sexual neurasthenia," and consist of hypochondria, irritability of temper, depression of spirits, inability for prolonged mental effort, forgetfulness, etc.

The only symptom which points directly to the involvement of the follicles of the prostate is

(*d*) **Prostatorrhœa,** which is the term given to the discharge of sticky, glairy mucus from the meatus after stool and after urination. It is due to the contractions of the muscles about the base of the bladder and rectum, pressing upon the prostate and squeezing out the contents of the prostatic crypts and follicles through their dilated ducts.

DIAGNOSIS.

As the clinical history of chronic prostatitis, seminal vesiculitis, and chronic posterior urethritis is similar, we can only make a differential diagnosis by a careful examination of the patient.

On passing a *bulbous bougie* into the posterior urethra extreme tenderness is felt by the patient. The *endoscope* shows the mucous membrane of the posterior urethra to be of a deep purple or violet color, bleeding slightly on introducing the tube, and covered possibly with granulations.

After washing out the anterior urethra, if the patient passes his urine in a glass pus may be present or not, and, at the end of the act of urination, Fuerbringer's hooklets, which have been squeezed out from the prostatic crypts, will appear floating in the glass as comma- or tadpole- shaped bodies.

The *expression-urine* test, which is made by stripping or expressing the contents of the prostate into the urethra, by massage through the rectum, is an important means of diagnosis, as we can in this way get the prostatic secretion for *microscopic examination*, and at the same time judge of the *size* and *consistency* of the prostate itself by the touch.

Boettscher's crystals are usually found on microscopic examination in the material expressed from the prostate, upon adding a drop of 1-per-cent. solution of acid phosphate of ammonia to it.

The crystals are distinguished by their dagger shape and the beautiful forms which they assume upon crystallization. These crystals only form in prostatic fluid, as their base does not exist elsewhere.

TREATMENT.

It is important, in the treatment of these cases, to secure the confidence of the patient and encourage him by explaining that his condition is one which can be cured, and that he is not impotent nor likely to become so, and that the mental disturbances of which he complains are due to a purely local condition which is not dangerous.

The first indication for treatment is to improve the general condition of the patient by means of diet and exercise in the open air.

Constipation is generally a prominent symptom, and it is necessary to regulate the bowels, using saline cathartics for their depleting action on the pelvic organs, which has some effect in relieving the congestion of the prostate.

Of course, all sources of erotic excitement should be interdicted on account of their effect in inducing congestion of the prostate. Under the head of *local treatment* we can speak of measures which have a more direct action upon the prostate itself.

Sitz-baths of hot salt-water of from ten to fifteen minutes' duration have an effect in improving the condition of the diseased organ. Irrigation of the rectum with a Kemp tube, with either hot or cold water, is often beneficial.

The most useful means of affecting the prostate itself is *massage through* the *rectum*. We can in this way express the contents of the glands, and after the patient has urinated, if an irrigation is used, the fluid will penetrate into the previously emptied crypts and follicles.

It is important at the same time not to overlook the posterior urethritis, but to cure that as well.

If there is a great deal of catarrhal inflammation, with much pus-formation, irrigations are in order; but, if the suppuration is only slight, instillations with an Ultzmann syringe are indicated. The endoscope is useful in a small number of cases when granulations are present or when it is necessary to make a strong application to the verumontanum.

Sounds should be used cautiously and as a last resource, and we should be sure that all acute inflammatory symptoms have subsided, since epididymitis, vesiculitis, etc., can readily be induced by their reckless use.

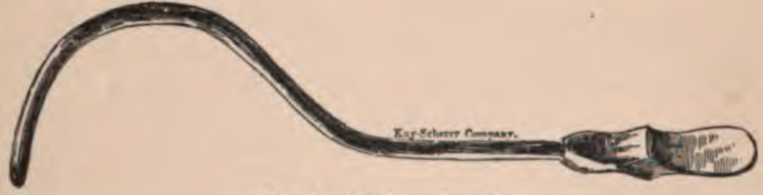


Fig. 24.—Benique Sound.

The *Benique sound* is particularly useful here, since it does not tear or lacerate the tissues, and, from its shape and weight, it exercises a certain amount of compression, which is a stimulant to the process of absorption.

The *psychrophor*, or cooling sound, is a hollow sound which allows a stream of water to flow through it, in order to keep it cold as it lies in the urethra. It is made in the form of an ordinary steel sound, but is more useful if made with the Benique curve. The psychrophor combines the effects of pressure and cold, and is often very valuable when prostatorrhœa is the chief symptom and occasioned by a relaxation of the mouths of the glands. It should be used every day or second day for from fifteen to thirty minutes at a time.

PROGNOSIS.

The prognosis of chronic prostatitis is, on the whole, not unfavorable, but improvement is slow, and treatment must be continued for a long time. Improvement can be readily noted by feeling the decrease in size of the prostate through the rectum, and after a short time under treatment the mental symptoms of the patient undergo a marked change for the better.

Relapses are apt to occur from a lighting up of the catarrhal inflammation and must be treated by suspending all local treatment with sounds and relying on irrigations or instillations of nitrate of silver into the posterior urethra.

DISEASES OF THE SEMINAL VESICLES.

CHAPTER VIII.

ACUTE SEMINAL VESICULITIS.

ACUTE inflammations of the seminal vesicles are generally due to gonorrhœa, although a chronic inflammation may originate from other causes.

A gonorrhœal inflammation of the interior of the cavity of the vesicle is excited when the gonococci pass from the posterior urethra through the ejaculatory ducts, and are deposited within the vesicle.

Its walls secrete pus and its cavity soon becomes filled up and distended with a purulent accumulation.

SYMPTOMS.

The symptoms are not very characteristic, and are merely those of the posterior urethritis, which, of course, is always present. Fever and a throbbing pain in the vesicles and tenderness in the suprapubic region are always observed.

Seminal discharges which are *red* or *chocolate colored* from the admixture with blood often occur. The blood may be derived from the cavity of the vesicle itself or may be acquired by the semen, from a congested posterior urethra, as it passes through it.

If the posterior urethritis is cured, the urine is clear at first, but later in the disease the vesicles pour out their purulent contents into the posterior urethra and the pus flows back into the bladder, discoloring the urine when it is passed.

DIAGNOSIS.

The diagnosis of seminal vesiculitis can only be made by *rectal examination*, and the vesicles can be felt swollen, soft, fluctuating, and intensely tender.

Epididymitis is a most frequent result of vesiculitis, and is brought about by some of the gonococci-laden pus-cells being carried through the vas deferens and deposited in the epididymis.

Peritonitis, which sometimes becomes general, may occur from the close relation which the peritoneum bears to the vesicles.

TREATMENT.

The treatment of acute vesiculitis is chiefly expectant, and consists in putting the patient to bed and giving a saline cathartic, which is always in order in every pelvic inflammation.

Hot sitz-baths and copious irrigations of the rectum with hot water are useful in allaying the inflammation.

If the posterior urethritis is severe, sandal-wood oil relieves the tenesmus and renders the urine less irritating.

Injections into the anterior urethra, of course, are contra-indicated, but above all things any attempt at massage or stripping the vesicles should be absolutely interdicted.

Under this plan of treatment most cases of acute vesiculitis will get well in from two to four weeks' time; but when resolution does not occur the disease passes into the chronic state.

CHRONIC SEMINAL VESICULITIS.

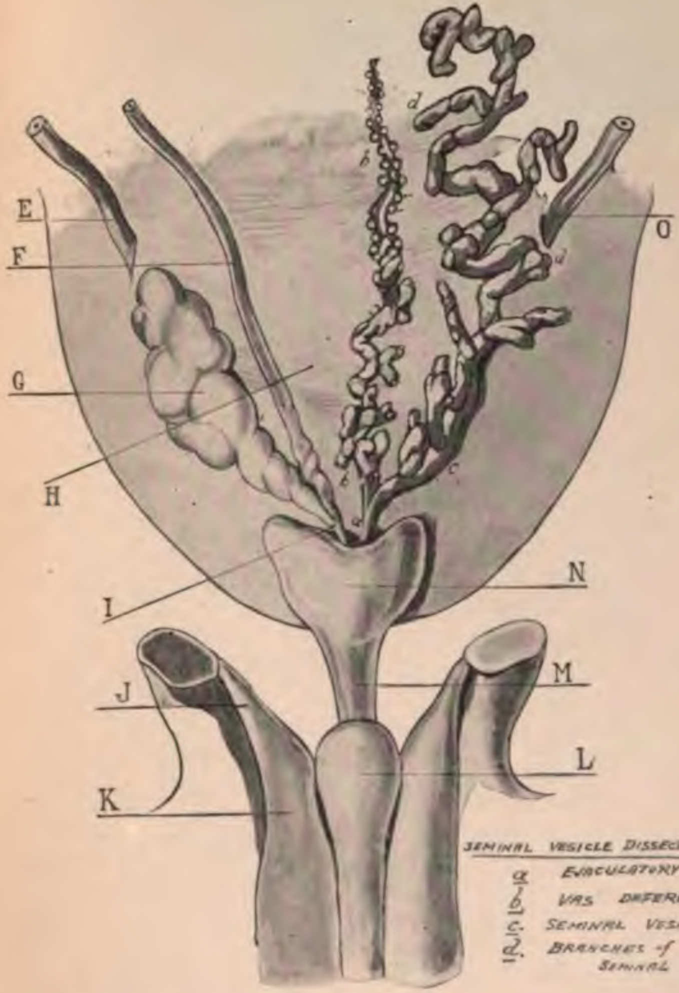
The condition of chronic inflammation of the seminal vesicles was but little understood until the publication of Eugene Fuller's first paper upon this subject in 1893. Chronic vesiculitis may originate from an *acute* attack of vesiculitis which does not undergo resolution; but, as a rule, it develops insidiously, as the result of the extension of a chronic inflammatory process which begins in the posterior urethra and extends through the ejaculatory duct. The ejaculatory duct is never compressed by the changes, but throughout the whole course of the disease it remains patulous, and sterility does not occur.

According to the classification devised by Fuller, chronic seminal vesiculitis presents itself in *two varieties*:—

I. **Atonic vesiculitis**, in which there is only an atony of the muscular fibres composing the walls of the vesicle.

II. **Inflammatory vesiculitis**, in which the walls of the vesicles are thickened and indurated as a result of inflammation, which may be simple, gonorrhœal, or tubercular in origin.

Either form of vesiculitis may exist by itself; but, as a rule, there is a combination of atony and inflammation of the vesicular walls.



SEMINAL VESICLE DISSECTED & DRAWN OUT.
a EJACULATORY DUCT.
b VAS DEFERENS
c. SEMINAL VESICLE.
d. BRANCHES of SEMINAL VESICLE

Fig. 25.—Diagram of the Seminal Vesicles. The Right Vesicle has been Dissected, and its Convolutions Drawn Out Straight.

E, Ureter.	*J*, Crus Penis.
F, Vas Deferens.	*K*, Corpus Cavernosum.
G, Seminal Vesicle.	*L*, Bulbous Urethra.
H, Base of Bladder.	*M*, Membranous Urethra.
I, Ejaculatory Duct.	*N*, Prostate.

O, Ureter.

Atonic Vesiculitis.

This form of vesiculitis may be induced by a previous attack of acute inflammation in the organ, which does not undergo complete resolution. It is more liable, however, to be provoked by some form of sexual abuse, which consists in a frequent repetition of the sexual act. In consequence the muscular fibres become exhausted, lose their tone, and the walls of the vesicles become thinned, atonied, and stretched. The cavities become distended with seminal fluid, because the weakened muscular fibres are no longer able to evacuate the contents, and the secretion becomes thick and inspissated.

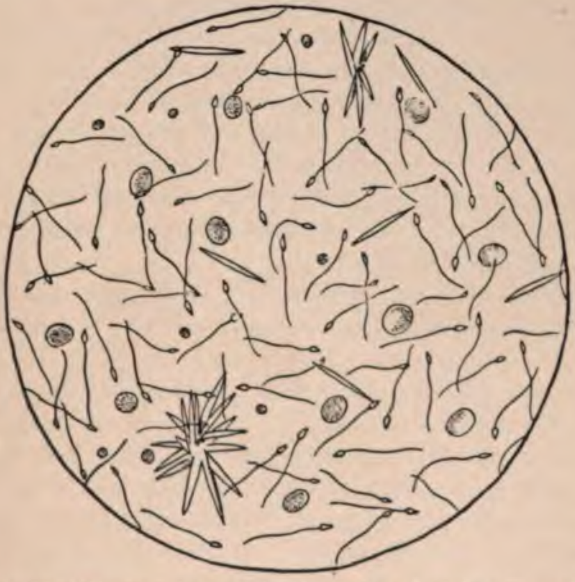


Fig. 26.—Microscopic examination of material expressed from Seminal Vesicles and Prostate, showing Spermatozoa, Pus-cells, and Boettscher's Crystals.

The vesicles are distended and enlarged, and feel like a swollen leech to the examining finger.

On stripping the vesicles the expressed seminal fluid appears abnormal.

The *expression urine* is not clear or slightly milky in color as it should be, but the expressed contents of the vesicles appear in the glass of urine as *coagulated masses* of *gelatinous material,* which often resemble casts half an inch long and as thick as a knitting-needle. These masses are the jellified contents of the vesicle, molded by the ejaculatory ducts, as they are squeezed through them.

The other form in which the inspissated semen is found resembles sago like globules floating in the urine.

After a time the atonic vesicle almost invariably becomes infected by some germ, often the bacillus coli from the rectum, and inflammatory changes are induced.

For practical purposes it is only necessary to consider two forms of chronic inflammation of the vesicle:—

(a) Chronic inflammation without perivesiculitis.

(b) Chronic inflammation with perivesiculitis.

When *perivesiculitis is absent*, there is no inflammatory infiltration or hyperplasia of the connective tissue surrounding the vesicles. The vesicle is large, and its walls are thinned and atonied, but they are hardened and sclerosed by fibrous changes, as a result of the inflammation which always occurs in this form within the walls.

A muco-purulent secretion may be abundant and accumulate within the cavity of the vesicle. Granulations often form within the cavity, causing hæmorrhage.

The entire vesicle may be filled with a blood-clot, or, if the bleeding is slight, the seminal discharges may be stained brown or chocolate color.

When *perivesiculitis is present*, a small-celled infiltration is thrown out in the early stages, surrounding and imbedding the vesicles. In time the [illegible] becomes [illegible] with fibrous connective tissue, which forms adhesions binding the vesicles down to the base of the bladder. [illegible] vesicles imbedded in fibrous tissue [illegible], and may easily be mistaken for [illegible] rectal examination.

After the fibrous tissue has existed [illegible] begins to contract and in consequence the vesicles are compressed and squeezed together so that they become smaller and [illegible].

The ejaculatory duct is never compressed by these changes, but always remains open; consequently [illegible].

ETIOLOGY.

As to the etiology of the inflammation of [illegible] vesiculitis, gonorrheal infection is [illegible] frequent cause.

Chronic vesiculitis may originate from an *acute* attack of vesiclitis; but it is more frequently due to a *gonorrhœal* inflammation of the posterior urethra, which extends along the ejaculatory duct and attacks the walls of the vesicle and often the perivesicular connective tissue.

Other causes besides gonorrhœa may induce chronic inflammatory changes in and around the vesical walls.

A *non-specific vesiculitis*, so called to distinguish it from the gonorrhœal, or specific, form, may arise *within* the cavity of the vesicle itself, as a result of an atonic condition of the vesicle.

Again, a low grade of chronic inflammation of the **posterior** urethra may be established as a result of sexual excesses, masturbation, etc., which spreads along the ejaculatory duct and attacks the vesical wall.

Finally, with old men who are beginning catheter life the traumatism often excites a subacute inflammation of the vesicles, which extends to the epididymis.

SYMPTOMS.

The symptoms of both gonorrhœal and simple vesiculitis depend chiefly upon the accompanying posterior urethritis, and consist in frequent urination and spasm or irritability of the cut-off muscle. On straining at stool a glairy, sticky discharge escapes from the meatus, which is the secretion expressed from the prostatic crypts by the muscular efforts, and is termed *prostatorrhœa*.

The *mental symptoms* are always very prominent, and the individual suffers from depression of spirits and melancholy, irritability of temper, and quarrelsomeness. Hypochondria is notably marked, and patients are alarmed over ridiculous trifles. They complain of the penis being shriveled, cold, or numb; that the testicles are retracted or that one hangs lower than the other; and suppose that the testicles are beginning to atrophy and they are growing impotent. In their alarm they consult some of the advertising quacks, who prey upon their fears and deluded ignorance.

Another important group of symptoms is connected with the *sexual function*. In the early stages there is an increase in the sexual desire, with frequent nocturnal emissions and premature ejaculation on coitus. The seminal discharges are often mixed with blood, which may be acquired from the posterior urethra or the cavity of the vesicles. As the case progresses, erections cease, the sexual desire is lost, and at last a condition of true impotence is established.

DIAGNOSIS.

The clinical history of these cases is generally significant of involvement of the vesicles, in the gonorrhœal form. The patient complains of a gonorrhœal discharge, which lasts, with intermissions, for years. Any slight indiscretion brings on an exacerbation, which is often mistaken for a fresh attack of gonorrhœa. The discharge lasts for a few days and then subsides, until another indiscretion lights it up again.

The diagnosis can only be made by **rectal examination,** and in order to determine the condition of the vesicles a very considerable amount of practice is necessary in order to attain the necessary *tactus eruditus.* As the vesicles and prostate are continuous, without a line of demarcation, when the perivesiculitis is present, it is difficult for the beginner to differentiate them, and, until one is experienced, a diagnosis of enlargement of the prostate is generally made, when the vesicles alone are enlarged and the prostate is normal in size.

Technique of Examination.—The patient, with his bladder moderately distended with urine, assumes the "leap-frog" attitude, bending over a chair and grasping the sides with the hands. The surgeon makes counter-pressure with one fist doubled up, pressing against the bladder, and the index finger of the other hand is inserted into the rectum. In order to get well up beyond the upper margin of the vesicle, it is necessary for the surgeon to support his right foot on a chair and by means of his knee make strong pressure against the elbow of his examining hand, in order to drive it well in.

If the vesicles are normal, they feel soft, and the amount of distension depends on circumstances. If *atonic vesiculitis* is present, they feel large, distended, tense, and very painful. If *perivesiculitis* exists, they are hard, indurated, and brawny, feeling like a piece of pork, on account of the infiltration through the connective tissue, which surrounds the vesicles and forms adhesions which bind them down upon the bladder.

After examining the condition of the vesicles their contents should be stripped or expressed by the examining finger, beginning at the upper margin and squeezing or stroking in a downward direction, so as to press out the contents through the ejaculatory duct. The quantity of expressed material which runs out at the meatus varies from a few drops to half a drachm or more. On examination the material is found to be thick and jellied or purulent, and the spermatozoa are dead. As the case improves, the spermatozoa regain life and motion.

TREATMENT.

The treatment consists in stripping or expressing the contents of the vesicles once in from five to seven days. The effects of stripping are to empty the vesicles of their inspissated contents, without forcing the muscular fibres to contract, and eject the semen, and through the rest thus afforded them the muscles recover their tone. The inflammatory thickening around the vesicle is absorbed as a result of the massage.

Contra-indications to stripping are (*a*) the existence of an acute attack of vesiculitis, (*b*) blood in the expressed material, (*c*) or excessive tenderness. With these conditions present there is always danger of setting up an epididymitis.

The posterior urethra should not be overlooked, but should receive appropriate treatment, with irrigations or instillations or by the endoscope. It is desirable, however, not to use local treatment to the posterior urethra and strip the vesicles at the same sitting, but to allow a couple of days to intervene. The duration of treatment is protracted, requiring from two to twelve months to effect a cure; but since Fuller's work upon the subject it is possible to cure cases which were beyond the reach of treatment before.

TUBERCULOUS VESICULITIS.

The seminal vesicles are usually involved by an infiltration with tuberculous nodules during the progress of a case of genito-urinary tuberculosis.

The infection may extend from tuberculous deposits in the posterior urethra or prostate or may result in consequence of an extension of the disease from the epididymis along the vas deferens.

It is supposed that the involvement of the vesicles in the majority of cases is *secondary*, although J. W. White has noted that the vesicles often show evidences of infection weeks or months before the tuberculous process is evident in the corresponding epididymis.

A chronic or subacute inflammation of the vesicle, either gonorrhœal or simple, is a strong predisposing element in allowing the tubercular process to become ingrafted upon these organs.

Uncomplicated tuberculous disease of the vesicles is never acute except in the presence of a mixed infection, either with the gonococcus or staphylococcus.

In this case an acute suppurative inflammation takes place within the cavity of the vesicle, which becomes filled and distended with pus.

Uncomplicated tuberculosis begins insidiously, and has a notable tendency to invade the surrounding tissues, and the process often becomes quiescent, although liable to take on renewed activity upon slight provocation.

A few cases, however, result in breaking down of the tuberculous nodules, with the formation of a perivesicular abscess, which discharges, either through the rectum or perineum, leaving a fistula.

The symptoms of tuberculosis of the vesicle are not marked, and this condition exists unsuspected until a rectal examination is made, disclosing hard nodules in the walls and perivesicular connective tissue.

As both vesicles are infiltrated and thickened as well as the connective tissue around them, the mass is continuous with the prostate, and it is no easy task to distinguish these structures apart. In advanced cases the prostate is almost always the seat of tuberculous deposits as well.

TREATMENT.

The treatment consists in hygienic measures alone, of which the most important is an out-door life in a suitable climate. Codliver-oil and creasote are the drugs most in vogue.

Operative treatment is, in general, not required in acute suppurative inflammation caused by a mixed infection, when the accumulation of pus takes place *within* the cavity of the vesicle, as the pus drains out into the urethra, through the ejaculatory duct.

When, however, the *perivesicular* tissue infiltrated with tubercular nodules breaks down and forms an abscess, it is necessary to evacuate the pus. This may be accomplished through a free incision in the perineum, or, as Fuller and Routier prefer, by thrusting a director into the tumefaction, through the rectum, and divulsing the tissues until an opening large enough to admit the finger is obtained.

Extirpation of the vesicle has been attempted a few times for tuberculosis, but the results are far from satisfactory.

From the inaccessible location of the vesicles, an extensive incision is required to reach them, and the hæmorrhage is difficult to control.

The bladder-walls and prostate are generally affected, and it is difficult or impossible to remove all the diseased material. The wound is slow in healing, and the confinement to bed exerts a bad influence upon the general condition of the patient; so that the tuberculous deposits, which are usually present elsewhere, advance in consequence.

STRICTURE OF THE URETHRA.

CHAPTER IX.

SPASMODIC STRICTURE.

SPASMODIC stricture is a pure functional disturbance, without organic change, consisting in a spasm or cramp-like contraction of the cut-off muscle surrounding the membranous urethra.

CAUSES.

(*a*) *Located in the posterior urethra.* An abnormal irritability from excess in coitus or masturbation.

(*b*) *Located in the anterior urethra.* A granular patch or stricture. The introduction of a foreign body, such as a sound or bulbous bougie, or a piece of calculus, formed in the bladder and making its way through the urethra, and finally the reflex irritation caused by a narrow meatus.

(*c*) *Point of irritation not in the urethra, but remote from it,* as an operation about the anus, fissures or fistula of the anus, and entozoa in the rectum.

(*d*) *Various psychical influences,* such as shame or embarrassment.

The influence of these various points of irritation is carried through the nervous system and causes, as a reflex, a contraction of the cut-off muscle.

ORGANIC STRICTURE.

DEFINITION.

A deposit of newly-formed fibrous connective tissue lying underneath the mucous membrane of the urethra and interfering with its dilatability. This fibrous tissue has a tendency to contract and produce a narrowing of the urethral calibre.

ETIOLOGY.

(*a*) *Inflammation*, which is generally due to gonorrhœa, occasions an infiltration of small round cells which, if not absorbed, becomes organized into connective tissue.

(*b*) *Traumatism.*—A laceration or rupture of the urethra is healed by the process of cellular infiltration, which is thrown out to a considerable extent and subsequently becomes organized into connective tissue. Traumatic strictures are always notably dense and tough.

PATHOLOGY.

In gonorrhœa, particularly the chronic form, the mucous membrane of the urethra becomes the seat of an infiltration with small round cells, which extends into the submucous connective tissue and finally involves the spongy tissue of the corpus cavernosum.

If the infiltration is *absorbed*, stricture does not form; but if absorption does not take place the infiltrating small round cells become transformed into *spindle cells*, and these are ultimately converted into dense, retracting connective tissue (scar-tissue). The transformation goes on slowly, and it requires at least one or two years before the soft infiltration has become organized.

The following changes in the tissues result from the contraction of the new fibrous tissue:—

The crypts and follicles of the urethra, which were surrounded by the periglandular infiltration, have been obliterated by the contraction of the fibrous tissue.

If the corpus spongiosum was involved, its meshes are obliterated in the same way.

The calibre of the urethra is narrowed by the presence of a mass of firm, bloodless scar-tissue, composed of fibrillated connective-tissue cells lying underneath the mucous membrane and covered with many layers of squamous epithelial cells.

Desquamation of these squamous epithelial cells continues for years, forming light filaments, which float in the urine.

VARIETIES OF ORGANIC STRICTURE.

I.—Soft or recent stricture is merely an infiltration of the tissues with inflammatory products, composed chiefly of small round cells.

II.—Cicatricial or inodular stricture is a mass of new fibrous tissue which has been formed by the transformation of the soft infiltration into true contractile connective tissue, and which, as it becomes older, grows tougher, denser, and more elastic.

A stricture is described as *linear* when it consists of a fine band of fibres, *annular* when it is composed of a broader band encircling the urethra, and *tortuous* when it is made up of a heavy, irregular mass of tissue, producing a great deal of distortion and narrowing of the urethral canal.

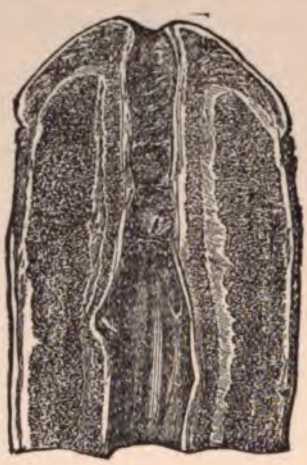


Fig. 27.—Linear Stricture.

NUMBER.

Traumatic stricture is always *single*, and occurs at the point of rupture in the canal.

Gonorrhœal strictures are apt to be *multiple*, and it is usual to have two or even three present at the same time.

LOCATION.

Sir Henry Thompson examined 320 anatomical preparations of stricture and found that in 215 cases the bulbo-membranous region was strictured and in 105 cases the stricture was in the first five inches of the canal.

The prostatic urethra is *never* strictured except as a result of traumatism, as inflammation here only produces a simple condensation and hardening of the submucous tissues, but does not narrow the calibre of the canal.

CHANGES WHICH TAKE PLACE BEHIND THE STRICTURE.

As a result of the obstruction to the free outflow of the urine, the urethra becomes enlarged and pouch-like, and a loss of its elasticity follows, from the frequent stretching which accompanies each act of urination.

This pouch retains a drop or two of urine, which decomposes, irritates the mucous membrane, and causes a chronic inflammation, with a gleety discharge.

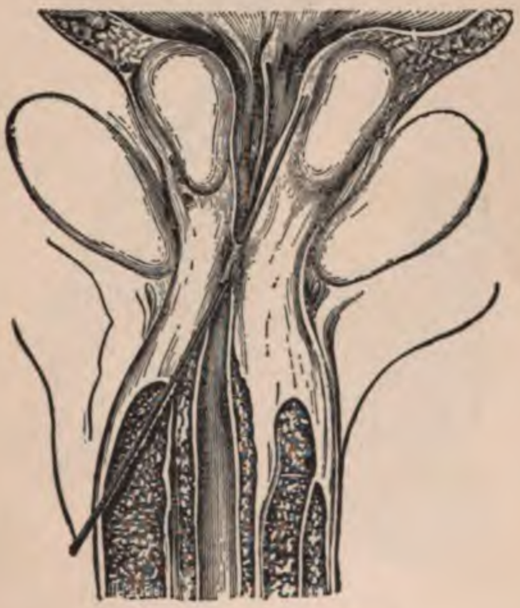


Fig. 28.—Annular Stricture.

The softened mucous membrane sometimes **ulcerates.** When a *small* ulceration occurs, a few drops of urine escape into the tissues and occasion a small abscess, which opens externally, forming a **urethral fistula,** or the urine may gain access to the tissues through the crypts and follicles which become dilated.

If a *large* ulceration takes place, a considerable quantity of urine

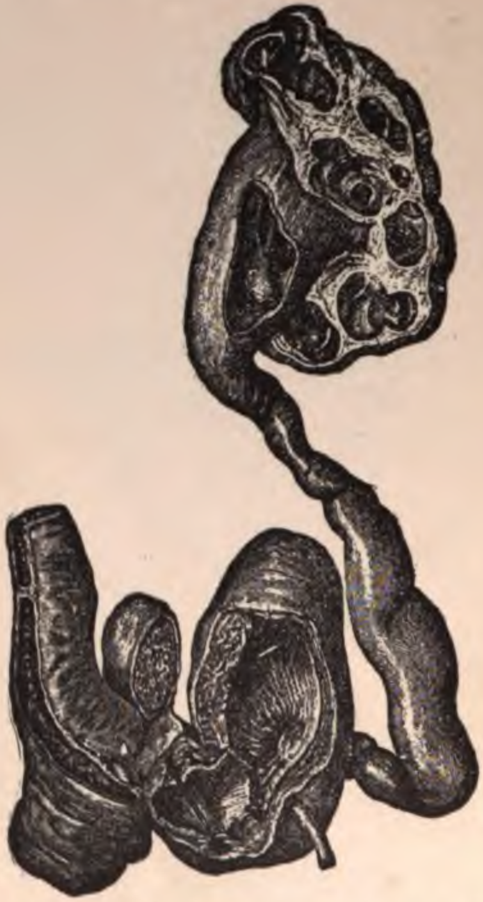


Fig. 29.—Changes behind a Stricture. Dilatation of pouch immediately behind Stricture. Hypertrophy and Contraction of Bladder. Dilatation of Ureter and Kidney (Hydronephrosis).

escapes into the loose cellular tissue, and **extravasation of urine** results.

CHANGES IN BLADDER AND KIDNEYS.

The increased effort on the part of the bladder to overcome the resistance offered by the stricture causes a **hypertrophy of the bladder-wall.** The muscular bundles project into the cavity of the bladder and diminish its capacity, and contraction of the cavity occurs.

In exceptional cases the walls become thinned and atrophied, and *vesical atony* results.

RESIDUAL URINE.

Definition.—*The urine which remains in the bladder after the patient has endeavored to evacuate it completely.*

Residual urine exists in 93 per cent. of cases of stricture, and increases as the age of the patient advances. It results in cystitis, with vesical atony and damming back of the urine upon the kidneys.

The **ureters** and **kidneys** become distended and dilated from the backward pressure of the urine, as a result of the muscular contractions of the bladder during urination.

The medullary tissue of the kidneys is atrophied, and sac-like dilatations form (hydronephrosis). Pyelitis and abscess of the kidney occur as a result of infection with bacteria conveyed upward from the decomposing residual urine.

SYMPTOMS.

(a) Frequent urination, in the early stages depending upon a congestion of the posterior urethra and exaggerated irritability. Later in the course of the case cystitis causes the desire to urinate frequently, and after the bladder has become atonied and full of residual urine the dribbling and incontinence, or overdistension, take place.

(b) Dribbling after urination results from some drops of urine, which are caught in the pouch behind the stricture, escaping a few minutes later.

(c) Distorted or Smaller Stream.—The patient requires a longer time to pass his water, and the stream is twisted or split.

(d) Gleety discharge from the meatus, composed of muco-pus and shreds in the urine, is occasioned by the catarrhal inflammation of the mucous membrane *behind* the stricture, from the irritation of the decomposing urine.

(e) Retention of urine occurs at times suddenly and early from acute congestion of the mucous membrane at the strictured point, and is apt to be excited by exposure to cold or wet and alcoholic or sexual excesses.

Later in the progress of the case the retention is caused by the direct obstruction of the outflow of urine, arising from the slowly contracting stricture.

(f) **Pain in the urethra** is neuralgic in character and inconstant, and may never be felt.

(g) **Interference with Coitus.** — The erections are generally feeble, and premature ejaculation occurs from congestion and irritability of the posterior urethra, or the semen may be retained behind the stricture until the engorgement of erection subsides, when it oozes from the meatus.

DIAGNOSIS.

The examination of the urethra, as a rule, is not very painful, but in nervous individuals it may be injected with a 4-per-cent. solution of cocaine.

For purposes of diagnosis the **steel sound** is too inexact, since, without disclosing any details, it will merely demonstrate that an obstruction exists in the urethra which prevents the sound from entering the bladder.

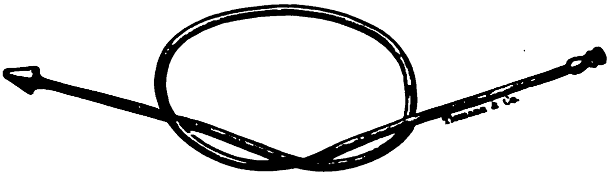


Fig. 30.—Flexible Bougie à Boule.

By means of the **flexible bulbous bougie** it is possible to feel the slightest pathological changes in the canal. As the bulb is introduced it glides along the urethra for six inches, until it fetches up against the cut-off muscle, and as it passes through the membranous urethra it is grasped by the muscle, but it feels freely movable again as soon as the posterior urethra is gained. When it reaches the sphincter of the bladder it is slightly grasped again, but slips by and moves freely in the cavity of the bladder.

The same sensations of resistance and grasping are felt on withdrawing the bulb, and we should guard against the error of mistaking the resistance of the cut-off muscle for a stricture in the deep urethra.

As the bulb is moved the *healthy* mucous membrane of the urethra feels soft and velvety, but, when a stricture is impinged upon, a sensation of jolting is felt. There is a perceptible roughness of the walls of the urethra, or one or more fine bands, like fiddle-strings, may be discovered. These changes are more easily felt upon the *withdrawal* of the bulb.

The **metal bulb** is less useful than the flexible bougie, as its smooth, polished surface glides over the roughnesses of the surface without being held by them.

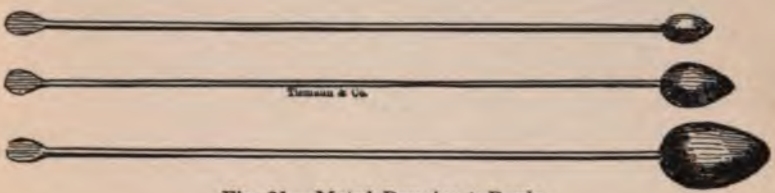


Fig. 31.—Metal Bougies à Boule.

The Otis urethrometer is chiefly useful in measuring the *calibre* and determining the dilatability of the urethra. It has the advantage that it can be introduced through a narrow meatus and expanded *behind* the stricture, and we are enabled to measure its calibre with accuracy.

In the case of very tight strictures, in which the calibre is too small to allow the passage of the smallest bulbous bougie, we have recourse to **whalebone filiform guides.**

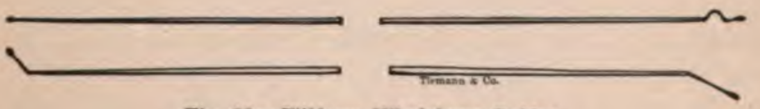


Fig. 32.—Filiform Whalebone Guides.

As long as urine flows out past a stricture we cannot speak of it as impassable, although the difficulty of entering it may be great on account of its fine, narrow lumen or because the opening is not central, but lying off to one side.

In order to find the opening it may be necessary to pass six or eight guides down upon the face of the stricture, and, with an assistant holding them firmly in place, try, by twisting and manipulating successively one after another, to find the opening through the stricture.

It is always desirable to inject ʒij of olive-oil into the urethra, [illegible] the face, and search the narrow opening through th stricture.

Another manipulation, which sometimes succeeds, is to pass a sound down upon the face of the stricture, and hold it pressed firml for ten to twenty minutes. In this way a certain amount of dilatation is often accomplished, and a funnel-shaped depression in the strictur is formed, with the opening at the bottom, instead of being locate off to one side, as before.

In not a few instances the opening through the stricture can b discovered by visual inspection through an endoscope.

If great difficulty has been experienced in introducing a guid through a stricture, it is better not to withdraw it and take the chance of getting it in again, but tie it in, and leave it, either fo the purpose of continuous dilatation or for operation.

TREATMENT.

All strictures, no matter where they are located, *if soft* and *recent*, are best treated by **gradual dilatation**. After the small round-celled infiltration has become converted into fibrillated connective tissue and is dense and contracted, dilatation no longer meets with the success which would have attended its use in the earlier stages. Even in these old cases, however, we can in many instances enlarge the calibre of the stricture and maintain it subsequently, by means of an occasional [illegible] which does not obstruct the urinary outflow [illegible] always well, in nearly every case, to try [illegible] proceeding to the more heroic measures.

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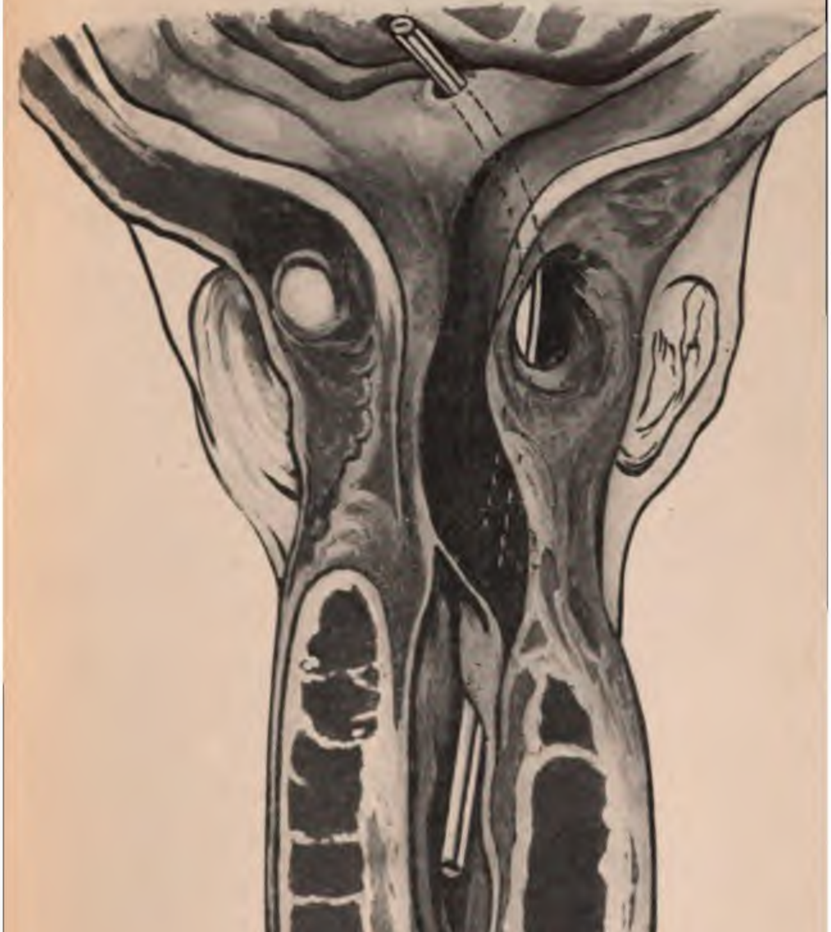

Fig. 33.—Stricture of the Bulbo-membranous Urethra and False Passage. The instrument has been forced through the tissues into the Bladder.

membranous urethra, which is **below No. 16 French in calibre, we** should always begin dilating with an **elastic bougie.**

If a metal sound is used, there is always danger of lacerating the inflamed and degenerated mucous membrane and pushing the sound into the periurethral tissue, making a **false passage.** If this accident occurs, the point of the sound is felt to be not in the median line, and is grasped firmly by the tissues, and a finger in the rectum readily detects the deflection of the instrument. Free hæmorrhage from the meatus follows the withdrawal of the sound.

The treatment of such an accident consists in rest, urethral and urinary antisepsis, and the avoidance of instrumentation for three weeks until the laceration has healed.

In using an elastic bougie we should select a size which is small enough not to lacerate the tissues. When the bougie enters the stricture the sensation of its being engaged and grasped is perceived. If it is held very tightly, rather than attempt to push it ahead, it is better to wait a few moments till the spasm has relaxed, and then push the instrument farther along.

After the elastic bougie has been passed through the stricture, it can be withdrawn at once. There is no object in allowing it to remain, since it is compressible and cannot produce any absorption in the stricture; it simply dilates it mechanically. If the instrument has been introduced with comparative ease, and without much pain, we may then introduce another of a larger size.

At the next sitting, which should not take place before two to three days have elapsed, we should first introduce the number passed upon the former occasion and then use larger sizes.

When the flexible bougie No. 16 French can be introduced with ease, we should begin **gradual dilatation with the steel sound.** It is important for the beginner to cultivate a suitable *technique* in using sounds, as unnecessary pain and sometimes actual damage to the tissues are caused by clumsy manipulation. The sound is sterilized by boiling or passing through the flame of a spirit-lamp, lubricated with vaselin or oil, and should be warm.

As the patient lies upon a table the operator stands upon his left side. Sir Henry Thompson advises that for the moment the operator should *forget* all his *anatomical knowledge*, and let the sound slip through the urethra *by its own weight*, guiding it with the utmost gentleness, and in no case should any pushing or prodding or force be used. This is well accomplished by holding the sound *stationary*, in a line with Poupart's ligament, and drawing the penis up over it until the point of the sound has reached the membranous urethra. The sound is then brought into the median line of the body, and as the point passes *through* the membranous urethra the handle will of itself describe the arc of a circle and gradually sink down between the thighs and parallel with them. When the handle is completely depressed, it may be rotated freely from side to side, thus demonstrating that the *point* lies in the bladder and is freely movable.

The largest-sized sound should be selected which will pass through the stricture without using force, withdrawn, and a still larger size introduced. It is desirable, in order to obtain the effect of the *prolonged* pressure, not to withdraw the sound at once, but to leave it lying in the stricture for from five to fifteen minutes.

At the next sitting we should begin with the sound last introduced, withdraw it, and pass the next larger size. The sounds should not be passed too frequently, and the rule is always to *wait until the reaction has subsided* before passing the sound again. The intervals vary, depending on the amount of reaction, from four to seven days.

There are different views as to the extent to which it is necessary to carry the dilatation, some authorities claiming that No. 25 French is sufficient, others maintaining that No. 30 French is the proper calibre. In any case there is always danger of *recontraction* unless the sound is passed at occasional intervals, in order to maintain the maximum calibre, for at least eighteen months. We can introduce the sound every week, and then increase the intervals to once in two, four, six, eight, and twelve weeks.

Effects upon the stricture of passing sounds are twofold, according to Oberlaender and Wossidlo:—

I. The mechanical stretching to which it is subjected.

II. A change in the vital functions of the tissues.

As a result of the distension, small *tears* occur in the mucous membrane or the stricture-tissue, as evidenced by slight bleeding. In a few hours a profuse mucous secretion occurs, indicating that a melting of the stricture-callus is taking place in consequence of the reaction. Under the increased vascularization which sets in, the stricture is partially absorbed.

After dilatation to No. 25 or 30 has been accomplished, the sound only acts upon the *narrowest* part of the stricture, and when it lies loosely here it accomplishes nothing further in the way of producing *absorption* of the stricture-callus, but only keeps its calibre *mechanic-*

ally dilated. But in many cases the stricture-tissue begins to recontract as soon as the use of sounds is discontinued.

Oberlaender claims that by dilating the stricture to more than No. 30 French, even 40 or 45, the fibrous tissue of the stricture is transformed into a "dead scar," which has no longer any tendency to contract. He states that, by systematic examinations with the endoscope, an evident improvement, which is perceptible to the eye, occurs only after the dilatation of the urethra has *exceeded* No. 30 French.

When the meatus is of normal size, it will not admit a sound large enough to accomplish this result, and, even if meatotomy is done, the meatus can only be cut to a size sufficient to admit a No. 30 French sound, and this calibre is not enough to accomplish the *over-distension* of the urethra, according to the views of Oberlaender. On this account he has devised the **Oberlaender dilator,** which can be introduced, with the blades closed, through a small meatus; after it is in place the blades are separated by turning the screw at the end, and we can get any amount of distension of the urethra which we may desire, even as high as No. 45 French. It should be distinctly understood that *forcible dilatation* or divulsion is not intended, but only a *gradual* and *temporary* dilatation of the stricture.[1]

Technique.—The urethra is cocainized, and the dilator, which is provided with a rubber cover, is oiled and introduced. If the sound which was passed on the case previously was No. 26, we separate the blades of the dilator to one number higher: *i.e.*, to No. 27.

The blades should be separated very slowly, and after we have screwed them apart *one* number, as indicated on the dial, we should wait until the pain has subsided, and then increase the separation to the next higher number.

After each dilatation a muco-purulent secretion occurs, which indicates the melting and absorption of the stricture-callus. If the discharge is profuse in quantity, it indicates that the stretching has been too vigorous. The usual intervals for dilatation are about ten days, on the average; and at each sitting the dilatation should be increased from one to two numbers.

The extent to which the stricture should be finally dilated is a matter of individual experience, and beginners generally make the mistake of dilating too rapidly. A sharp bleeding or an excessive secretion following dilatation is an indication that an error has been made in the technique, and that the dilatation has been too rapid or too great. If such an accident occurs, it is necessary to wait from three to six weeks, until all tenderness of the urethra has disappeared and the secretion has diminished and is but slight in amount.

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[1] Kollmann's dilator is a more recent instrument, and is to be preferred, as it is provided with four dilating blades, and is less apt to cause a laceration of the urethra than Oberlaender's dilator.

In regard to the extent to which dilatation should be carried before the stricture can be said to be cured, Oberlaender states that the endoscope is the only guide. The mucous membrane should show a normal healthy surface and the fibrous tissue should be transformed into a "dead scar," which has no longer any tendency to contract. As soon as this condition is attained, all further dilatation can be suspended, quite irrespective as to whether the stricture has been dilated to No. 28 or 30 or to 40 or 45 French.

As with the use of sounds after active treatment has ceased, the stricture should still be dilated, with the dilator, at occasional intervals to prevent relapses.

Relapses sometimes occur, and can be recognized by the endoscope and treated with dilatations again, before any decided contraction has had time to occur. For this reason, it is desirable to examine cases with the endoscope at intervals of three or six months after treatment has ceased.

Strictures of very small calibre, which are so tight as not to permit the passage of the smallest flexible bougie, can often be penetrated by means of the **filiform whalebone guide.** After this instrument has penetrated the stricture and the end has entered the bladder there are three courses open to us:—

(a) Continuous Dilatation. — If a bougie is passed through a stricture which grasps it tightly and is left in place for twenty-four hours, the stricture ulcerates superficially, but *widens rapidly,* so that the bougie lies loosely within it, and can be withdrawn, and a larger instrument introduced to take its place.

In cases of retention of urine, a guide may be left tied in the bladder, and the urine escapes, flowing away alongside of the guide.

On the following days larger instruments may be introduced and tied in until the stricture is sufficiently dilated to admit being treated with sounds.

Continuous dilatation, while formerly much in vogue, is now almost obsolete, methods *b* and *c* having taken its place.

(b) Tunneled Sound and Gradual Dilatation.—A tunneled sound is threaded over the guide and introduced through the stricture, dilating it. The sound is then withdrawn and a larger one introduced in the same way. This is a very useful method of treating tight strictures, which are not too hard and fibrous to admit of gradual dilatation.

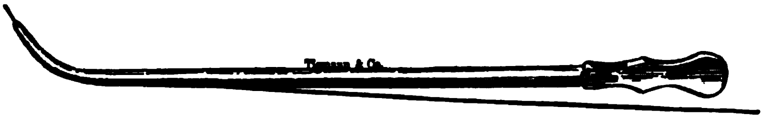

Fig. 34.—Tunneled Sound.

In case of retention of urine, where it is necessary to relieve a distended bladder, *Gouley's tunneled catheter* can be used in place of the tunneled sound, and the urine withdrawn through it, by pulling out the stylet and thus making the hollow shaft permeable.

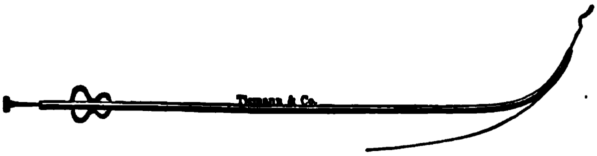

Fig. 35.—Gouley's Tunneled Catheter.

(c) **Immediate Operation.** — Internal urethrotomy by Maisonneuve's urethrotome or external urethrotomy. (See the following section on the operative treatment of stricture.)

TREATMENT OF STRICTURE BY SURGICAL OPERATION.

As we have before stated, a *soft* or *recent* stricture, no matter in what part of the canal it is located, is best treated by *gradual* dilatation with sounds or dilators; but, as the stricture becomes older, it grows dense, firm, and fibrous, and the gradual dilatation is no longer practicable.

We are obliged to resort to a division or cutting through the stricture-band by means of the knife, and to that end we employ two different operations:—

(*a*) Internal urethrotomy.
(*b*) External urethrotomy.

The choice of the operation depends entirely upon the point in the urethra at which the stricture is located, and for the purpose of making the indications for operation clear we can divide the urethra into two regions:—

Region I extends from the meatus backward for a distance of five inches, and its termination corresponds to the peno-scrotal junction.

Region II includes the bulbous and membranous urethra. It extends from a point five inches distant from the meatus back as far as the prostatic urethra.

The operation of internal urethrotomy through the meatus is restricted to Region I, and external urethrotomy through a perineal incision is only applicable to strictures located in Region II.

INTERNAL URETHROTOMY.

Preparatory Treatment.—Before any operation on the urethra the urine should be rendered aseptic by salol, gr. x t. i. d., and if strongly acid it should be neutralized by citrate of potash or bicarbonate of potash.

The urethral canal should be irrigated with Thiersch's fluid or salt solution to free it from germs as much as possible.

It is desirable to fill the bladder with Thiersch's fluid by means of a catheter, and leave the fluid in, to flow out after the operation, bathing the cut surfaces and diluting the urine, when the patient urinates later.

Anæsthetic.—A 4-per-cent. solution of cocaine is, as a rule, sufficient, unless in the case of very extreme strictures, which require a general anæsthetic.

The **technique** of internal urethrotomy is as follows: If the meatus is small it should be incised to the size of No. 30 French, and any stricture-bands which are within an inch of it should be divided at the same time with a straight, probe-pointed bistoury.

The Otis urethrotome, preferably with Bangs's modification, is introduced into the urethra closed. After its point has entered behind the stricture the blades are separated, by means of the screw, to the full extent the calibre of the stricture will allow. The instrument is then withdrawn until the projection at the end catches against the stricture and is held. We know by the feeling of resistance that the projection which conceals the knife lies in close contact with the point we wish to cut. The knife is then withdrawn for an inch, cutting through the stricture, and toward the *roof* of the urethra. And we can afterward readily demonstrate that the stricture has been cut through by separating the blades more widely than was before possible.

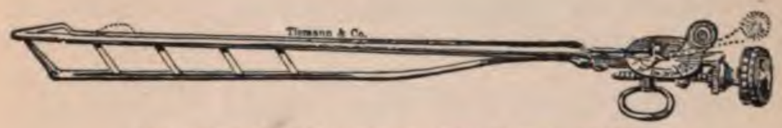

Fig. 36.—Otis Urethrotome, as Modified by Rand.

The knife is again pushed back into its place of concealment in the instrument, and the urethrotome is drawn out toward the meatus, and any other stricture-bands present are cut in the same way.

In every case treated by internal urethrotomy the question arises: "How deep shall we make the incision through the stricture?" This is still a point under discussion, since almost every author has his own line of procedure. Dr. Otis devised a scale of measurements of the penis, as a guide to depth of the incision, and claims that a penis three inches in circumference should be cut to admit a No. 30 French sound, while a penis four inches in circumference should be cut so that a No. 38 sound can be passed.

I believe we will have better results by treating each case on its *individual merits.* The stricture which is comparatively *light* and does not involve the whole corpus spongiosum may be *completely* divided, as shown by the entire *absence* of *resistance* when the blades of the urethrotome are separated, after cutting the stricture.

In the case of a *heavy* stricture which involves all the corpus spongiosum we cannot divide the whole thickness of the stricture, but must content ourselves with cutting it through *partially,* and trust to keeping the channel open by passing sounds *frequently* for the rest of the patient's life.

After the stricture has been cut to the extent which we desire and the urethrotome has been withdrawn, a bulbous bougie, No. 30 or 32 French, is introduced into the canal, to make sure that all bands are completely divided.

After-treatment.—The patient should be kept in bed and on light diet and directed to drink freely of water and milk to dilute the urine.

In order to keep the cut surfaces from growing together, a straight sound can be passed every day for the first week and subsequently every second day, and, after a month, once a week. Later the passage of the sound need only take place once a month; but there is always danger of *recontraction* unless a sound is passed at intervals.

Dangers of Internal Urethrotomy.—Mortality, 2 to 5 per cent.

(*a*) Hæmorrhage.

(*b*) Infiltration of urine through wound into tissues, producing abscesses and septicæmia.

(*c*) Urinary fever. It is especially important to see that the kidneys are healthy before doing an internal urethrotomy.

(*d*) Deformities of the penis subsequently.

When a deep cut is made into the roof of the urethra a large amount of scar-tissue is formed in healing. This scar subsequently contracts, and bends the penis into the shape of a bow, which causes erections to be painful, and renders coitus difficult or impossible.

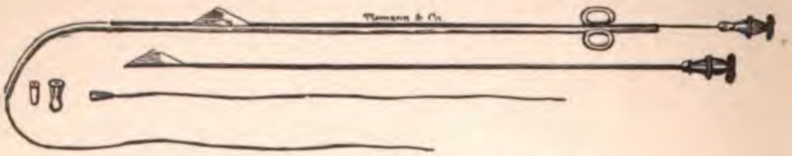

Fig. 37.—Maisonneuve's Urethrotome.

Strictures of small calibre, under No. 18 French, are not large enough to admit the passage of an Otis urethrotome. In these cases a filiform guide should be passed through the stricture and by means of (*a*) Maisonneuve's urethrotome the stricture can be divided, from before backward, and afterward cut larger with an Otis urethrotome, or we can introduce over the guide (*b*) a divulsor and *stretch* the stricture so that an Otis urethrotome can be used.

The operation of **divulsion** as formerly practiced has been entirely superseded, as it is inexact and dangerous, producing extensive lacerations of the urethra, which are followed by hæmorrhage and septic absorption.

Summary of Indications for Internal Urethrotomy.—This operation is applicable only to stricture of the pendulous urethra which is dense and fibrous and cannot be treated by gradual dilatation with sounds, and located *less than five inches* from the meatus.

It is especially adapted to the following varieties:—

(*a*) Distinctly fibrous or non-dilatable stricture.

(*b*) Resilient stricture. (Definition: Elastic and India-rubber-like, contracting quickly after instrumentation.)

(*c*) Irritable stricture. (Definition: Standing instrumentation badly and easily excited to inflammation.)

(*d*) Cases where urethral fever follows each introduction of a sound.

When a stricture is located *more* than five inches from the meatus, internal urethrotomy is no longer a suitable operation, on account of the danger of **hæmorrhage,** which is difficult to control. The blood flows backward, overcomes the resistance of the cut-off muscle, and fills the bladder.

The means of controlling the bleeding are as follow:—

(*a*) Pressure on the perineum by means of a crutch, firmly applied against it.

(*b*) Introduction of a full-sized catheter into the bladder, which makes pressure on the urethral walls and closes the bleeding vessels.

(*c*) Perineal section and introduction of a catheter through the wound into the bladder, with firm gauze packing around it.

Another danger is **infiltration of urine,** which soaks into the tissues through the cut and produces *abscess* and *sepsis.*

EXTERNAL URETHROTOMY.

In consequence of the dangers of hæmorrhage and infiltration of urine, we have recourse to the operation of external urethrotomy through the perineum when the stricture is located in the **bulbous** or **membranous** urethra, viz.: in Region II.

Forms of Operation.—(*a*) With a filiform guide: Gouley's operation, modified by Rand.

(*b*) Without a guide: Wheelhouse operation.

Gouley's Operation With a Guide.—*Technique.*—A *filiform guide* is introduced through the stricture and into the bladder and a tunneled sound is slid over the guide, till its point rests against the stricture. The urethra is opened in the perineum, by cutting down upon the end of the tunneled sound.

The sound is withdrawn, the guide being held with forceps, to prevent its being pulled out of the bladder.

The free end of the whalebone guide is then brought out through the wound (the other end remaining *in situ*, in the bladder). Rand's tunneled knife is then threaded over the guide and pushed *through* the stricture, dividing its fibres, into the bladder. A gorget is introduced into the bladder, and any undivided fibres of the stricture are

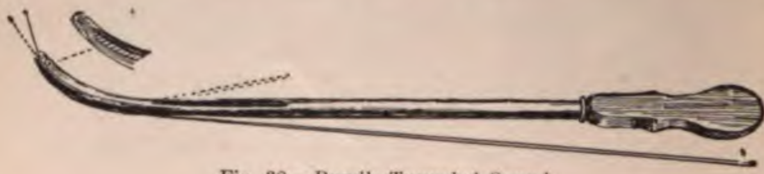

Fig. 38.—Rand's Tunneled Sound.

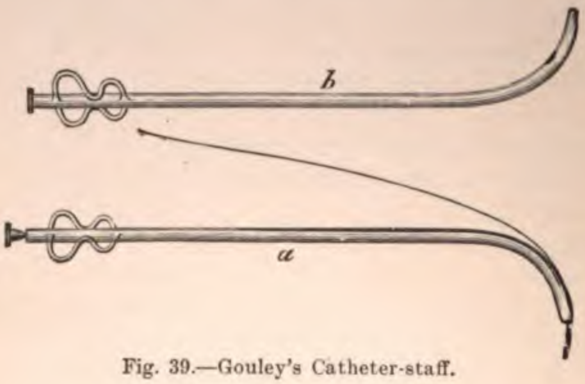

Fig. 39.—Gouley's Catheter-staff.

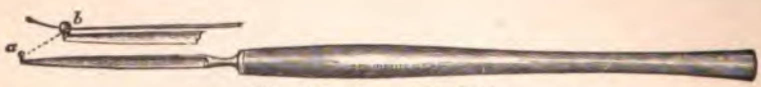

Fig. 40.—Tunneled Knife.

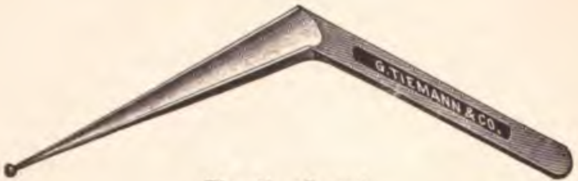

Fig. 41.—Gorget.

cut with a blunt-pointed straight bistoury, using the gorget as a director.

The operation of external urethrotomy is rendered comparatively simple, if we are able to introduce a filiform guide into the bladder, and it may be impossible to reach the bladder without the assistance furnished by the guide. For that reason it is desirable to persevere in our efforts to get a guide in; when we fail, however, we are obliged to do the operation of

External Urethrotomy Without a Guide, as Devised by Wheelhouse.—*Technique.*—A Wheelhouse staff is introduced into the urethra, till its end rests against the face of the stricture. The urethra is opened through the perineum, cutting down upon the end of the staff. The wound in the urethra is retracted by small hooks on

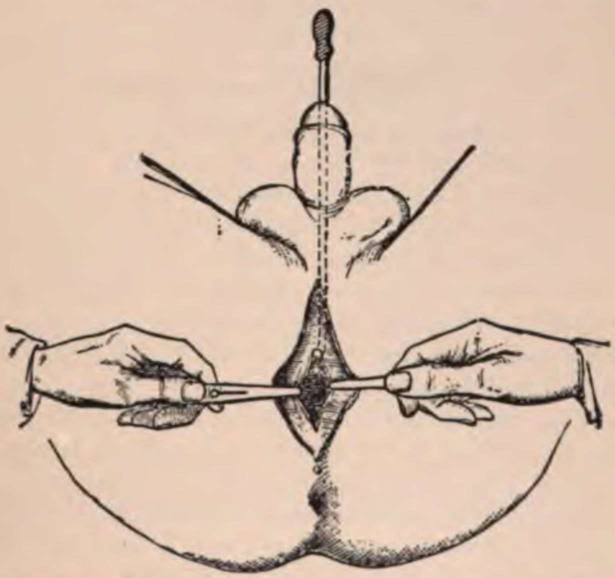

Fig. 42.—External Urethrotomy. Wheelhouse Operation, Exposing the Urethra.

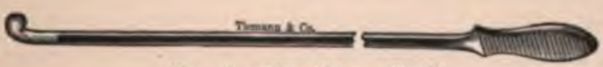

Fig. 43.—Wheelhouse Staff.

either side, and the upper angle of the wound is held up by hooking the projecting end of the staff against it and drawing it as much out of the way as possible.

Search is then made for the distal end of the urethra by means of Arnott's grooved probe or a filiform guide and by inspection. If the opening is found and the probe introduced, a Gouley knife is slipped along the groove in the probe and the stricture is cut through.

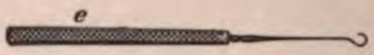

Fig. 44.—Small Tenaculum for Holding Apart Incised Urethra in External Urethrotomy.

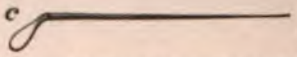

Fig. 45.—Arnott's Grooved Probe.

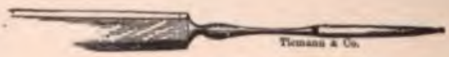

Fig. 46.—Gouley's Beaked Bistoury.

In case of failure to find the opening we may have recourse to **Guitéras's trocar.** The rami of the pubis form a triangle, with the symphysis at the apex. The urethra lies immediately under and one-half an inch below the symphysis.

If our anatomical knowledge enables us to locate the urethra accurately, by *stabbing*, in the proper place with the trocar, we will puncture the stricture-tissue, and the trocar will lie in the prostatic urethra beyond, as can be demonstrated by pushing the trocar along through it, until it reaches the bladder, and withdrawing the stylet, when a stream of urine will flow through the hollow cannula. A knife is then introduced along the groove in the instrument and the stricture divided in the usual way.

In the event of this procedure not being successful we may have recourse to **retrograde catheterization.** This operation consists in making a suprapubic cystotomy and introducing a staff into the bladder and through the prostatic urethra and along the canal until its further progress is barred by the stricture, through which it cannot pass. The end of the staff is felt, covered by stricture-tissue, by means of a finger in the wound, and the tissue which intervenes between the end of the staff and the perineal wound is cut through with a knife, in this way bringing the end of the staff into view in the wound. The urethra is thus made again one continuous canal.

We may have recourse to still another procedure, which is to let the patient recover from his anæsthetic and when consciousness is restored and the bladder is full of urine, if the patient endeavors to pass water, a few drops of urine may be seen to escape at one point in the perineal wound, thus indicating the location of the end of the urethra, which had not been discoverable before.

Treatment After External Urethrotomy.—*Hæmorrhage* during the operation is controlled by clamping the bleeding vessels with artery-forceps, which, if necessary, may be left *in situ* for twenty-four hours in the wound, before being removed. As a rule, this is unnecessary, as the general oozing can be perfectly controlled by firm pressure by means of gauze, packed into the wound and around the catheter.

An important indication is to secure good drainage of the bladder and prevent the urine from coming in contact with the freshly made wound until septic absorption is guarded against by the formation of granulations. This is readily accomplished by carrying a No. 30 French catheter through the wound and into the bladder, and taking a stitch through both lips of the wound and the catheter to prevent it from being forced out. The end of the catheter is attached to a long tube, which drains into a bottle on the floor.

In a case where, in addition to cutting a stricture in the deep urethra, a stricture in the anterior part of the canal had been divided by internal urethrotomy, a straight sound should be passed through the meatus and anterior urethra down to the catheter on the second day after the operation and upon every alternate day until the drainage tube is removed from the wound and bladder. The gauze packing should be removed from around the tube in forty-eight hours and the wound irrigated and repacked. It is desirable to irrigate the bladder with Thiersch's fluid every day. About the seventh day after the operation, when granulations have formed, the catheter is removed from the wound and a curved sound passed through the

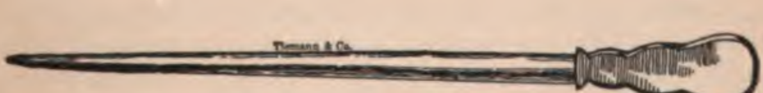

Fig. 47.—Straight Steel Sound.

into the bladder. The sound is passed every second day into the bladder until the perineal wound is healed and the patient discharged.

The patient may be allowed to get out of bed and sit in a chair a week after the operation, and the ability to hold the water and pass it at will is regained about the same time.

Recontraction of the stricture is almost certain to take place, after division of a heavy stricture, unless the patient passes a sound, at occasional intervals, for the rest of his life, and this fact should be earnestly impressed upon him, so that he may not neglect the precaution.

Résumé.—External urethrotomy is applicable *only* to strictures located *more* than five inches from the meatus: *i.e.*, in the bulbous and membranous urethra.

Summary of indications:—

(*a*) Rupture of urethra.

(*b*) Urinary infiltration.

(*c*) Impassable stricture complicated by retention of urine.

(*d*) Tough fibrous stricture of small calibre which is difficult to dilate.

(*e*) Traumatic stricture.

MISCELLANEOUS.

Stricture at the meatus may be congenital or the result of gonorrhœa. In these cases dilatation is useless, and the proper procedure is meatotomy, which is accomplished by cutting the meatus upon the *floor* by means of a straight probe-pointed bistoury.

There is a tendency on the part of the cut surfaces to unite afterward, which is counteracted by *dilating* the meatus three times daily with a sound, or preferably a glass cone.

Stricture Complicated by a False Passage.—A large number of cases of *old* deep-seated stricture, which have been under instrumentation a number of times, are apt to have one or more false passages, which have been made by the bungling use of a sound.

A false passage adds to the difficulty of entering the bladder with a catheter or sound, because it is very apt to engage the point of the instrument and "pocket" it.

In these cases the *filiform bougie* is very serviceable in furnishing a guide into the bladder. Our plan of procedure is to introduce one guide after another through the urethra, in hopes that one of them will slip *past* the opening of the false passage, pass through the stricture, and thus into the bladder.

Combined external and internal urethrotomy is always demanded when both pendulous and bulbous portions of the urethra are the seat of strictures.

It is also often a good plan to open the deep urethra and drain the bladder with a catheter after an extensive internal urethrotomy, in order to prevent the urine from passing over the fresh cut surface in the urethra and causing urinary fever.

TREATMENT OF INTRACTABLE STRICTURE BY RESECTION OF A PORTION OF THE URETHRA.

Occasionally dense fibrous strictures of the deep urethra, with a large amount of periurethral induration, are met with, which are sometimes gonorrhœal, but generally traumatic, in origin.

Such patients have usually had their strictures divided by external urethrotomy several times, but, in spite of the regular passage of sounds, they contract rapidly, and it is impossible to keep them open.

A conservative method of dealing with such cases is to lay bare the urethra and excise the strictured portion.

This was first done by König in 1882, who cut out the strictured portion of the urethra and brought the separated edges again into apposition and stitched them together. In 1892 Guyon and Albarran resected strictures and allowed the space between the cut ends of the urethra to fill in with granulations.

The author has used the method devised by Fuller with satisfactory results.

Technique.—A sound is introduced through the meatus and the perineal urethra exposed by dissection. If the bulbous urethra is involved, the scrotum must be split in two halves in order to lay the urethra bare. The strictured portion of the urethra is entirely excised with curved scissors, with the exception of a narrow bridge of urethral tissue one-quarter of an inch wide on the roof.

A large catheter is inserted at the lower angle of the perineal wound to drain the bladder, and a No. 26 French soft catheter is passed through the meatus and perineal urethra, till its end rests against the perineal tube. The perineal tissues are then sewed around the urethral tube with catgut, thus building up a channel which will eventually form the new urethra.

The skin-edges are then brought together with superficial sutures, and, if the scrotum has been divided, a couple of deep silkworm-gut sutures may be introduced.

Both tubes may be removed in one week, but a sound should not be passed for three weeks.

EXTRAVASATION OF URINE.

Extravasation of urine is one of the severest and most dangerous complications which occurs as a result of stricture. It is by no means uncommon, and Sir Henry Thompson found it occurring 8 times out of 217 cases of stricture.

In its attempts at evacuation the straining and pressure of the hypertrophied bladder cause a rupture of the thin walls of the pouch-like dilatation of the urethra, lying behind the stricture, and the urine escapes into the periurethral cellular tissue.

When, as is most frequently the case, the rupture occurs *in front* of the subpubic ligament, the urine burrows through the cellular tissue of the scrotum and penis and extends upward toward the hypogastrium.

Abscess rapidly forms, the tissues become gangrenous and slough, and spontaneous evacuation of the pus and urine occurs, with considerable destruction of tissue, leaving urinary fistulæ. The septic condition is always very pronounced, and such patients usually die unless an operation is performed promptly after the rupture occurs.

When the rupture of the urethra takes place *posterior* to the subpubic ligament, the burrowing of urine takes place in a different direction. In this case the urine cannot make its way forward through the cellular tissue of the penis, but it burrows under the deep layer of the perineal fascia and accumulates in the prevesical space, forming a swelling above the symphysis. From this point it extends and inflammatory swelling and suppuration of the connective tissue within the abdomen occurs and the patient dies of pyæmia.

TREATMENT.

Urinary extravasation demands immediate operation in order to save the patient's life and prevent extensive sloughing and loss of tissue.

An external urethrotomy should be performed and the bladder drained through a catheter in order to prevent further escape of urine into the tissues. At the same time the collections of pus and urine in the tissues should be opened up, drained freely, and packed with gauze.

If the prostatic urethra was ruptured behind the subpubic ligament and extravasation has taken place into the prevesical space, the pus and urine should be evacuated by means of a suprapubic cystotomy.

CHAPTER X.

URINARY FEVER.[1]

URINARY fever is also spoken of as urethral fever or catheter fever, and may be defined as a set of symptoms of which chill and fever are the most prominent, generally occurring in consequence of a traumatism to the genito-urinary tract. It occurs in two forms: acute and chronic.

Acute Form.—Shortly after instrumentation of the urethra or bladder—*i.e.*, passing sounds, dilatation, urethrotomy, or cystoscopy—a *chill* occurs lasting half an hour or more and followed by fever, and the urinary secretion is lessened or entirely suppressed. After a few hours the temperature falls, with profuse sweating, the kidneys begin to secrete freely again, and the urine contains abundant urates and sometimes albumin.

The chronic form may result as the outcome of an acute attack or may be developed insidiously without attracting the attention of the patient, who only complains of malaise, dyspepsia, etc. The course of the fever is prolonged, and the patient loses strength and emaciates and is often mildly delirious at night. This condition is generally combined with severe cystitis and often pyelitis, and in the end the patient succumbs to the cachexia induced by the chronic poisoning.

PROGNOSIS.

Urinary fever is a serious disease, especially in old men or with those having diseased kidneys. The most important factor in the recovery of *acute* cases is the freedom with which the kidneys secrete urine, and, when the kidneys do not resume their function after an acute attack or were previously diseased, the outlook is grave.

ETIOLOGY.

Urinary fever was formerly thought to be due to the shock and disturbance to the nervous system, attendant upon passing an instrument into the urethra, and this view is still held by many authorities, but it is generally regarded at the present time as an *infectious disease* which is brought about by the entrance of pathogenic organisms into the blood-circulation, through wounds or lacerations of the urethra or bladder. Among various other organisms the bacterium coli commune plays an important part in the causation of urinary fever.

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[1] "Die Stricturen der Harnröhre," by H. Wossidlo.

Micro-organisms are introduced into the blood-circulation in the following ways:—

(*a*) The sound or dilator may have been dirty and infected with germs, which are introduced into an accidental laceration made in the mucous membrane by the instrument.

(*b*) The instrument was clean, but the urine was septic and contains micro-organisms from a cystitis or pyelitis, and the attack of fever follows very soon after the first passage of urine, through the urethra. The micro-organisms in the urine pass into the blood through an accidental laceration in the mucous membrane and occasion the attack.

(*c*) When instrument and urine are both sterile, pathogenic organisms may be already existent in the urethra, lying especially in the parts *behind* a stricture, and are introduced into the circulation through a traumatism.

The *course of the fever* depends upon the size of the wound and the quantity of micro-organisms absorbed. If a small amount of septic material is taken up in oft-repeated doses, the fever runs a chronic course.

In case the kidneys were diseased and incapable of eliminating waste-products completely, before the onset of the fever, the attack is more severe, inasmuch as the kidneys fail to excrete the products of nitrogenous waste and, in addition, cannot clear the blood of the accumulated toxins.

TREATMENT.

Prophylaxis.—In order to avoid urinary fever the following conditions are necessary:—

I. Healthy kidneys. As already stated, imperfect elimination of urea predisposes strongly to urinary fever; hence it is important to ascertain that the kidneys are healthy before operating on the urethra.

II. Complete asepsis of instruments and genito-urinary tract. It is easier to secure asepsis of instruments (see section on care of instruments) than to sterilize the genito-urinary tract. A good deal can be accomplished in that direction by irrigations of the bladder and urethra before instrumentation with either boric acid or salt solutions.

The urine should be sterilized by the administration by the mouth of salol, gr. x, three times a day, or urotropin, gr. viij, three times a day.

III. All instrumentation should be made with the utmost gentleness to avoid causing lacerations. By avoiding any tearing of the mucous membrane there is no opportunity for micro-organisms to make their way into the blood-current and so excite the fever.

Treatment of the Attack.—As already stated, after the chill the fever subsides, when the patient breaks out into a profuse sweat, and the indication, therefore, is to encourage free perspiration, by putting the patient to bed, surrounding him with hot bottles, and giving a hot drink.

Phenacetin is useful for the headache, and a saline cathartic should be given the next day to complete the elimination of the toxin.

The *chronic form* of urinary fever is generally accompanied by cystitis, and here the indications are to secure free drainage of the bladder and keep it clean by frequent irrigations. If the inflammation has extended from the bladder upward through the ureters and involved the kidneys, the indication for treatment is to increase the reduced secretion of urine to the normal standard again by means of milk diet and large draughts of spring-water.

Salol and Urotropin should be given as urinary antiseptics and small doses of quinine are useful as a tonic.

CARE OF URETHRAL INSTRUMENTS.

All the instruments which are used in the urethra should be perfectly smooth and highly polished, since any roughness upon the surface will abraid the delicate mucous membrane and expose the patient to the dangers of septic absorption and urinary fever. Instruments should also be well lubricated before introduction. Vaselin is most commonly employed, but it has the disadvantage of coating the mucous membrane and preventing its contact with irrigating solutions used afterward. Lubrichondrin is a preparation made from Irish moss, is slippery and soluble, readily washes off, and is preferable to use. Any lubricant should be kept in and used from the flexible tubes, which protect it from the air and keep it sterile.

Sounds should be kept in a drawer and prevented from knocking against each other, as that destroys the polish, and after using they should be washed with a piece of gauze in hot water with soap. Afterward they ought to be dipped in alcohol as far as the handle and flamed, or they may be boiled in a solution of washing soda.[1] The soda is added to prevent rusting. Urethrotomes, tunneled sounds, lithotrites, silver catheters, and endoscopic tubes should be scrubbed with a brush in hot water with soap and afterward boiled in soda solution. Soft-rubber catheters should be washed off outside and running water allowed to flow through them; but this is not enough for disinfection, and, in order to accomplish this, they must be boiled in plain water afterward.

Flexible gum-elastic bougies and catheters, filiform guides, and rubber-dilator covers and cystoscopes do not stand boiling. They can be disinfected by washing with gauze and soap in hot water, and exposing afterward to the vapor of formalin, in the formalin sterilizer (made by Schering & Glatz, New York).

A more recent method of sterilizing gum-elastic and soft-rubber catheters now in use in Berlin is to immerse them in the following solution:—

℞ Glycerin,	
Water	aa 8 ounces.
Corrosive sublimate	8 grains.

After six hours' immersion laboratory experiments show the catheter to be sterile, and prolonged exposure of the instrument in the solution does not roughen or crack its surfaces.

Cystoscopes may be kept in a jar filled with 5-per-cent. carbolic-acid solution, and by keeping them point downward with the eye-piece above the level of the fluid the telescope is not damaged.

Knives with fine, delicate edges are dulled by boiling, but can be sterilized by placing in alcohol or 20-per-cent. carbolic solution or in the formalin sterilizing cabinet.

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[1] Flaming is to be preferred, as boiling roughens their surfaces.

DISEASES OF THE BLADDER.

CHAPTER XI.

CYSTITIS.

ETIOLOGY.

It is an event of great rarity for a perfectly normal bladder to become the seat of inflammation, while, on the other hand, any non-inflammatory affection of this organ is most apt to be complicated, sooner or later, by the element of germ-infection, with inflammation ensuing.

There are numerous conditions which may act as **predisposing causes** to cystitis, although they may exist indefinitely without actually causing inflammation. The one most frequently met with in practice is the retention of *residual urine*, occurring in cases of stricture and enlarged prostate or resulting from paralysis of the nerve-supply to the bladder, depending upon a fractured spine or a myelitis. Retention of urine in itself cannot cause inflammation so long as the bladder remains free from infection with micro-organisms; but stagnant urine affords an excellent culture-medium for the growth and development of germs which may be introduced into the bladder, and the retention of urine, if long continued, impairs the vitality of the mucous membrane by keeping it congested.

Chronic congestion of the mucous membrane may occur without the presence of retained urine, and may be occasioned by calculus, some forms of prostatic enlargement, and in women by pregnancy and menstruation.

The normal epithelium of the bladder offers a barrier to the penetration of micro-organisms so long as its cells are intact; but if the bladder-walls are congested for some time, the superficial cells are loosened and desquamated and the softer cells underneath are exposed, allowing the entrance of germs.

The hyperæmia also causes the small blood-vessels to rupture, on account of the increased vascular pressure.

Exposure to cold is often considered an exciting cause of cystitis, but it can only act in an indirect way by lowering the vitality of the tissues, so that germ-infection may the more easily take place.

The various predisposing causes above mentioned cannot in themselves excite inflammation. They operate by preventing the bladder from being evacuated and allowing residual urine to accumulate and form a favorable culture-medium for germs, or by producing congestion of the mucous membrane which lowers its vitality and causes desquamation of its protective cells, thus opening up avenues for infection.

The exciting cause of an attack of cystitis is invariably **micro-organisms.** Normal urine is an aseptic fluid, free from germs, and can be injected into the peritoneal cavity without causing suppuration. In every case of cystitis various forms of cocci and bacteria are always present.

Many of these organisms are incapable of causing cystitis, if they find their way into a normal bladder, which can be completely emptied of its urine, because they are voided along with the urine, without causing any injury to the bladder.

On the other hand, the staphylococcus pyogenes and the urobacillus liquefaciens septicus and virulent cultures of the bacillus coli possess the power of breaking up urea and forming ammonia, and on this account they are able in themselves, without the aid of a favorable predisposing cause, to excite cystitis.

Micro-organisms Found in Cystitis.—C. Mansell Moullin[1] examined the urine from 30 cases of suppurative cystitis, most of which were old men with enlarged prostates. Cases of tubercular and gonorrhœal cystitis were excluded, and the following results were obtained:—

The reaction was acid or neutral in 24 and alkaline in 6.

Micro-organisms were present in abundance in all of them.

The bacillus coli was present in 21 of the acid urines and in 4 of the alkaline cases.

Streptococcus pyogenes occurred in 4 acid and in 3 alkaline cases.

The urobacillus liquefaciens was present in 5 of the alkaline cases.

In addition a staphylococcus was present in 8 and a diplococcus in 2.

These examinations show that the bacillus coli is the organism most frequently present in cystitis when the urine is acid, and the urobacillus liquefaciens septicus when it is alkaline.

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[1] "Inflammation of the Bladder and Urinary Fever," Blakiston, 1898.

Bacillus coli in shape is a short round bacillus with rounded ends which is found normally in the intestinal canal. The virulence of its cultures depends upon the source from which they are taken, a growth from the contents of the healthy intestine having less virulence than one taken from a case of infantile diarrhœa, while a culture from choleraic discharges is virulent in the highest degree.

Unlike other micro-organisms, the bacillus coli has but little effect in causing the urine to become alkaline by decomposing its urea, and the urine retains its acid reaction for a considerable length of time. Although the bacillus coli is a harmless saprophyte in the intestine, it has the effect, when injected into the tissues, of causing an abscess or of inducing toxæmia or general septicæmia.

The urobacillus liquefaciens septicus is chiefly of interest from its power of decomposing urea and causing the urine to become alkaline within a few hours.

Cultures of the bacillus coli, if injected into the bladder, often fail to produce cystitis unless a predisposing cause, such as retention of urine or congestion, be present.

If, however, the urobacillus gains admission to the bladder, cystitis almost invariably follows on account of the ammonia which is set free from the decomposed urea and which acts as an exciting cause for the inflammation.

The streptococcus pyogenes and staphylococcus pyogenes aureus are both capable of inducing septicæmia if they gain entrance into the blood-circulation, and locally they attack the bladder-walls, causing diffuse inflammation with suppuration.

The streptococcus does not decompose urea, and when it is found in alkaline urine the decomposition has been effected through the agency of another micro-organism, which is often the urobacillus.

Experimental and clinical evidence serves to show that, while all cases of ordinary suppurative cystitis are dependent upon these or similar organisms, inflammation of the bladder cannot be induced by their mere introduction into it, so long as the urine can be completely evacuated and its walls are in a healthy condition. The urobacillus liquefaciens alone is capable of exciting cystitis in a normal bladder, through its property of decomposing urea.

If, however, there be residual urine retained in the bladder, behind a stricture or enlarged prostate, or if the bladder-wall is congested and eroded from the irritation of a calculus or the administration of cantharides, cystitis will surely result from the introduction of the other forms of micro-organisms.

Avenues Through which Micro-organisms Reach the Bladder.—Germs may enter the bladder by the following routes:—

I. Through the urethra.

II. They may descend with the urine from the kidneys.

III. They may pass through the blood-circulation direct to the bladder.

IV. They may pass through the lymphatics from adjacent organs.

I. Infection Through the Urethra.—As already stated, the bacillus coli is responsible for the larger number of cases of cystitis. Its chief habitat is the intestine, where it is always present, although varying greatly in virulence. It is also usually to be found, but mixed with other organisms, upon the glans penis and under the prepuce and in the fossa navicularis, and in women it exists in the meatus urinarius and the folds of the vulva.

The deep urethra in the male probably does not afford a resting-place for germs while it is healthy. When, however, it is altered by disease, either stricture or enlargement of the prostate, the dilated pouch, containing stagnant urine and mucus, affords a favorable hibernating-place for bacteria.

Cystitis does not occur in men with healthy urethras, except as a result of instrumentation, but in cases of enlarged prostate it is of common occurrence, even when no instruments have been used. In most instances where the bladder is infected from the urethra a catheter or sound is the means by which the germs are introduced.

Although the instrument may have been sterile before introduction, it may have been infected by brushing against the patient's clothing or acquired germs from contact with the glans penis or meatus, or it may have carried germs along from a pouch behind a stricture or enlarged prostate in the urethra itself.

But, unless the predisposing causes of congestion of the bladder-wall or residual urine be present, the micro-organisms will usually be swept out of the bladder with the first act of urination, without causing any damage.

II. Infection of the Bladder with Bacteria which Descend in the Urine from the Kidneys.—The bacillus coli, which exists in profusion in the intestinal canal, readily makes its way through the wall of the intestine, into the blood-circulation and notably so, if diarrhœa or intestinal disease be present. After gaining the blood-circulation the bacilli are eliminated by the kidneys, and passing out with the urine gain entrance into the bladder, and under the existence of favoring conditions, such as congestion or residual urine, cystitis is excited.

III. Infection of the Bladder Through the Blood-current. — Infective emboli occurring in the course of some general disease may be carried through the capillaries, and local foci of disease in the bladder may be originated through their agency. This cause of infection, however, seldom occurs except as a result of tuberculosis.

IV. Micro-organisms Formed in an Adjacent Organ may be Carried to the Bladder Through the Channel of the Lymphatic Vessels.— This form of infection has been proved experimentally and will serve to explain the occurrence of cystitis in women who are the subjects of salpingitis and endometritis and in whom the micro-organisms probably pass from the ovaries or uterus to the bladder, through the lymphatics.

CLASSIFICATION.

Cystitis begins acutely, and frequently becomes chronic. Various attempts to group the varieties from an etiological or anatomical stand-point have been made, but for practical uses a division into *simple, suppurative,* and *specific* cystitis serves the purpose.

Under the term **simple cystitis** is understood the inflammation of the bladder which is not caused by germ-infection, but which results from a mechanical cause, such as the irritation from a calculus or crystals in the urine or from a chemical irritation caused by cantharides. Simple cystitis exists as a theoretical condition only, for, as a matter of fact, the complication of *germ-infection* occurs in every case, and in a few hours the bladder becomes infected with micro-organisms, and the simple inflammation is converted into **suppurative cystitis.**

PATHOLOGICAL CHANGES IN THE BLADDER.

Location.—The disease process is most marked in the region of the trigone and particularly so around the ureters and urethral orifice. The fundus is usually nearly or quite normal.

The mucous membrane is the part usually affected, but the inflammation may attack the deeper structures and the muscular, subserous, and even the serous coats may be involved.

In acute cystitis the cystoscope affords a means of studying the changes in the mucous membrane of the bladder. Its color is found to be brilliant scarlet, with branching lines marking the course of the distended vessels, which bleed readily. The surface of the mucous membrane has lost its polish, is ragged and velvety, and has flakes of lymph adhering to it. In severe cases the epithelium is detached, leaving *erosions*.

In very septic cases portions of the mucous membrane slough away, and hang from the walls in shreds, and minute abscesses may form in the submucous coat or among the muscular layers. Micro-organisms are invariably present; the urine is filled with them and they lie on the surface and between the epithelial cells.

The **pathological changes in chronic cystitis** resemble those of the acute form, but are more marked. The erosions are deeper, sometimes forming actual ulcers. The surface of the mucous membrane is black or slate colored, from the escape of blood-pigment into the tissues through small capillary ruptures.

In the early stages the muscular coat may undergo a true hypertrophy of its fibres, but, as a rule, the prolonged inflammation and the vascular degeneration lead in time to a condition of fibroid induration and sclerosis of the bladder-wall. The walls are thicker and denser than normal and their elasticity is entirely lost. As a result of those conditions the cavity of the bladder often becomes so small and contracted that it can only hold a few ounces. The bladder-wall on contracting falls into folds, with spaces between them, from which it is difficult to empty the urine even with a catheter.

In time the spaces become stretched, forming **sac-like dilatations,** which may be as large as the bladder itself.

These sacs are only covered by serous membrane, and have no muscular fibres; so that they cannot empty themselves of their contained urine, and, filled with stagnant decomposing urine, they become a favorite seat for stone-formation.

On the other hand, the bladder-walls, instead of being hard and fibrous around a small contracted cavity, may become thin and flaccid, and the cavity may be distended to a capacity of a quart or more.

Membranous Cystitis.—As a result of intense septic infection of

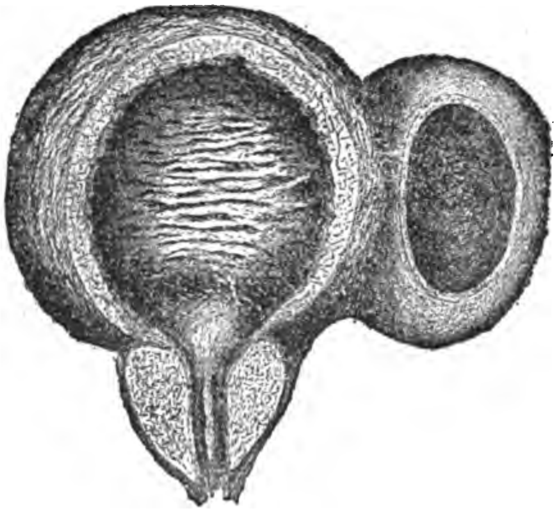

Fig. 48.—Formation of a Sacculation in a hypertrophied Bladder from Prostatic enlargement and prolonged Cystitis.

the bladder, combined with pressure on its blood-vessels, sufficient to shut off the circulation and cause gangrene, a false membrane may form within the bladder, which is thrown off as a coat of its walls.

The microscope shows these coats to be composed of epithelial cells, lymph, urinary salts, and micro-organisms entangled together.

The slough may make its exit through the urethra or the whole thickness of the bladder-wall may slough into the cavity of the abdomen.

SYMPTOMS.

Local Symptoms.

I. Frequent Urination.—The inflamed and irritable condition of the bladder-walls and posterior urethra renders the bladder very intolerant of any tension and after a small quantity of urine collects it is expelled. Prolonged standing or jolting increases the desire to urinate in cystitis and particularly so when the inflammation depends upon a vesical calculus.

II. Painful Urination.—In acute cases the pain is more or less constantly present over the bladder, and is aggravated by the act of urination. As the desire to urinate comes on, the pain increases, and as the bladder contracts the pain may be agonizing, and is felt in the bladder and rectum, and radiates to the end of the penis and down the thighs.

In severe cases there is a desire to urinate every few minutes, and the act of urination is accompanied by great straining or tenesmus.

In the presence of stone or posterior urethritis of gonorrhœal origin the pain is increased after the act of urination, on account of the inflamed walls of the bladder being squeezed together by the muscular contractions. Strangury is noted in the most severe cases only, in which the pain is continuous and where the patient makes violent and straining efforts to urinate and only expels a few drops of blood-stained urine each time.

In chronic cases but little pain is experienced, except in the instances of enlarged prostate, when the bladder is hypertrophied and very much contracted.

III. Pyuria.—Pus in the urine is a constant occurrence in every case of cystitis. If the urine is acid in reaction the pus appears as a cloud distributed through the urine, but if reaction is alkaline and ammoniacal, the pus is coagulated and takes the form of a viscid, tenacious, ropy mass, at the bottom of the vessel.

IV. Hæmaturia.—A slight amount of bleeding occurs from a rupture of the congested capillaries in the bladder-walls, in all cases of cystitis. The blood is always intimately mixed with the urine and disseminated through it. A gush of pure blood following the act of urination is a characteristic sign of inflammation of the posterior urethra.

Constitutional Symptoms.

The constitutional symptoms in cystitis are caused by the toxins which are absorbed into the circulation, and their severity depends upon, first, the amount of the poison absorbed and, secondly, upon the rapidity of its absorption.

If the bladder is able to empty itself thoroughly, absorption does not take place to any great extent and the constitutional disturbance is not marked.

If, on the other hand, the bladder cannot evacuate itself completely or if pyogenic organisms have invaded its walls, severe constitutional disturbance follows.

In acute cystitis the bladder can usually empty itself, and the temperature is not high and the constitutional symptoms are not particularly marked; but if, from some cause, obstruction to the outflow of urine exists, and the protecting epithelium has been desquamated from the bladder-wall, an opportunity for the absorption of toxins is afforded and the constitutional symptoms are grave.

This is particularly true in cases of mixed infection, in which the bacillus coli is associated with the urobacillus liquefaciens septicus or staphylococcus pyogenes.

The ammonia which is formed from the decomposed urea helps to break down the protecting layer of bladder epithelium, and the erosions thus formed allow large quantities of toxins to pass rapidly into the blood-circulation.

In old men at the beginning of catheter-life an asthenic form of cystitis is not uncommon. It is always associated with chronic urinary fever and is often fatal.

In chronic cystitis the constitutional disturbance is slight because there is very little absorption of toxins from the bladder. Grave symptoms occur only when an acute attack is ingrafted upon a bladder which has suffered with chronic inflammation. Some organism which is capable of decomposing urea enters and ammonia is formed. The tissues, altered by long-continued inflammation, respond violently to the irritant, the kidneys become involved, and septic poisoning follows.

DIAGNOSIS.

The symptoms of frequent urination and pain, when accompanied by turbidity of the urine from pus and occasionally blood, are very characteristic of cystitis. The presence of pus or blood in the urine, however, only signifies that there is a condition of suppuration somewhere along the genito-urinary tract. In chronic cases of cystitis it is always important to exclude such local conditions as stricture, stone, or enlarged prostate, and in acute cases the absence of gonorrhœal or tubercular infection should be ascertained and the state of the prostate and seminal vesicles should always be examined.

The use of the *cystoscope* is not admissible in acute cases, on account of its increasing the existing irritation, but in chronic cystitis it is indispensable. By its means it is possible to exclude malignant disease and tuberculosis of the bladder and calculus, and the presence or absence of an enlarged and projecting middle lobe of the prostate can be readily ascertained.

Pyelitis can at the same time be diagnosed or excluded, sometimes from the appearance of the ureteral openings, but with absolute certainty by catheterizing the ureters.

The *microscopic* examination is almost as important, to determine the character of the micro-organisms, the variety of the urinary crystals, and the form of the epithelial cells, from which some conclusion as to the involvement of the kidneys may be drawn.

PROGNOSIS.

Acute cystitis may heal completely or it may become chronic.

The cure of chronic cystitis depends entirely upon its causation. When it is due to stone, stricture, or enlarged prostate, and its cause can be removed by surgical interference, the prognosis is good.

Chronic cystitis in itself rarely causes death except in the aged and debilitated, who die from absorption of toxins and urinary fever; but, if inflammation of the bladder continues for some time, the infection travels up the ureters, and the kidneys become the seat of disease which ultimately proves fatal.

PREVENTIVE TREATMENT.

Suppurative cystitis is always caused by micro-organisms, of which the most common form is the bacillus coli communis, which originates in the intestine and may make its way into the bladder through the urethra, general blood-circulation, or lymphatics.

Under ordinary conditions the bacillus coli is a harmless saprophyte, but diarrhœa, constipation, and other intestinal disorders convert it into an extremely virulent pyogenic germ. Hence it follows that the intestinal canal should be kept as aseptic as possible by means of calomel, purgatives, and intestinal antiseptics. Local foci of infection, where germs can grow in the urethra and around the external genitals of the male and female, should be kept clean and aseptic.

As long as the mucous membrane lining the bladder remains unbroken and the organ is capable of being completely emptied of its contained urine, bacteria may be introduced into the bladder without harm, as they are soon flushed out by the stream of urine, and cystitis can rarely be induced unless the bladder-wall has been congested and the epithelial lining eroded or it contains residual urine, caused by an enlarged prostate, stricture, or vesical atony. On this account it is important to attend to any local diseased conditions which interfere with its proper emptying, and allow residual urine to accumulate or the bladder-walls to become congested and eroded.

Catheters and sounds must be sterile before using, and the external genitals should always be cleansed before instrumentation (see section on asepsis of instruments).

GENERAL TREATMENT OF ACUTE CYSTITIS.

In all but the mildest cases the patient should be kept in bed until the severity of the symptoms is controlled and the acute stage is past.

The room should be maintained at an even temperature, for the congestion of an inflamed bladder is notably increased by chilling the surface of the body and by the muscular efforts of walking.

Purgatives.—A brisk calomel purge should always be administered at the beginning of an attack for the purpose of clearing out the intestine, which is the main source from which the bacillus coli is derived. It has been shown experimentally that rectal obstruction is almost immediately followed by the appearance of enormous numbers of colon bacilli, which come either from the kidneys or directly from the rectum to the bladder through the thin intervening walls. During the progress of the case a daily movement of the bowels should be secured by Hunyadi or Rubinat water.

Hot sitz-baths at a temperature of 100° or 105° F. are serviceable in allaying the vesical irritability and tenesmus. The exposed part of the patient's body should be well covered with blankets while taking them.

The diet should be light and largely composed of milk. Meat should not be allowed at all or only in small quantities. Fresh fruit may be taken in moderation. Alcohol is interdicted unless perhaps in old men who need a stimulant, in which case whisky well diluted may be used.

Diluents.—Pure spring water or distilled water may be taken freely, unless the desire to urinate is very frequent and urgent. The various mineral waters of [illegible] [illegible], etc., invariably render the urine bland, simply through the water they contain. Alkalies should never be administered as a routine treatment, [illegible] [illegible], as the urine is frequently alkaline in these diseases, [illegible] [illegible] [illegible] from a fixed alkali, and the internal use of alkalies do harm by increasing the alkalinity. If the urine is highly acid and deposits uric-acid crystals, bicarbonate or citrate of potash is useful in allaying the irritation.

Opium is often required in acute cases to control the vesical tenesmus, pain, and irritability. It is given preferably in $^1/_2$-grain morphia suppositories, but may be used by the mouth as well. It is unwise to inject morphia into the bladder. If the bladder mucous membrane is unbroken, it will not be absorbed, and, if erosions are present, absorption may occur too quickly, and give rise to symptoms of poisoning.

The same holds true of **cocaine**, which has little or no effect in causing local anæsthesia of the bladder, as it does in other mucous membranes, and has the great disadvantage of very materially increasing the congestion of the mucous membrane, at times sufficiently to cause retention of urine.

Balsams.—Sandal-wood oil has a very beneficial action in allaying the too frequent urination and pain of cystitis, in its acute stage. Later in the attack, when the secretion of pus has diminished so that the urine, instead of being turbid, presents only a fine cloudiness, the oleoresins, such as turpentine, copaiba, cubebs, and fluid extract of pichi, and minute doses of cantharidin dissolved in alcohol, have an effect in quickly causing a cessation of the suppuration and a clearing up of the urine.

Urinary Antiseptics. — The antiseptics are supposed, through their germicidal properties, to destroy the inflammatory process at its root. Salol may be considered as a representative of the group. It is given in doses of gr. x three times a day, and acts promptly as a destroyer of micro-organisms, through the constituent carbolic acid, which, from its decomposition, is set free in the urine. In the same way boric and benzoic acids, in doses of 20 grains per day, exercise their germicidal power, and are to be chosen when the urine is alkaline in reaction from the presence of a fixed alkali.

In the group of aniline derivatives may be mentioned methyl-blue and Urotropin. Methyl-blue, first recommended by Einhorn, in the quantity of 15 grains a day in tablets or capsules, is often of service when the urine contains large quantities of bacteria. The urine, from using this drug, becomes greenish at first in color and later of an intense blue. Urotropin, which dissolves phosphatic concretions and causes phosphaturia to disappear with rapidity and often permanently, in many cases, has proved to be a urinary antiseptic of great value, and particularly so in cases of chronic cystitis accompanied by ammoniacal decomposition of urine. It does not destroy the micro-organisms, but prevents their growth and development. The proper dose is 24 grains per day; if this is exceeded, burning in the urethra and frequent urination occur.

LOCAL TREATMENT OF ACUTE CYSTITIS.

Bladder-washing, which is so essential in chronic cases, is entirely inadmissible in the acute forms. The only varieties of local application which can be used without doing harm are:—

Instillations of Nitrate of Silver.—These can be used with advantage in the most acute cases of cystitis. The principal indications for their use are painful and frequent urination, provided the bladder is capable of emptying itself. By means of an Ultzmann syringe 20 drops of nitrate-of-silver solution, increasing in strength from gr. j to gr. x, are deposited every second or third day in the posterior urethra, from which point it flows back into the bladder and trickles over the surface of the trigone, which, together with the posterior urethra, are the parts most involved in the inflammatory process. The bladder should be empty, before the instillation, as the nitrate of silver is neutralized if it comes in contact with urine. Instillations are mainly useful in acute cases, although sometimes of service in chronic cystitis.

GENERAL TREATMENT OF CHRONIC CYSTITIS.

After the severe pain and frequent urination of the acute stage have passed off, the urine still contains pus in large quantities and has to be voided more frequently than in the normal condition.

The patient should no longer be confined to bed, but should have the benefit of the fresh air, although much walking is, of course, out of the question for him. He should be instructed to clothe the body in flannel, to wear woolen stockings, and India rubbers in damp weather, and cautioned particularly to avoid exposure to a draft or dampness.

The sandal-wood oil is of less use in chronic cases than in the acute, but the oleoresins are of value; and the urinary antiseptics, Urotropin and salol, have here their field of greatest usefulness. By means of the general treatment but little can be accomplished, and the main reliance is the local treatment.

LOCAL TREATMENT OF CHRONIC CYSTITIS.

Indications.—I. Remove any local source of irritation within the bladder or any obstacle to its evacuation. Palliative measures for the cure of cystitis are of no avail if a calculus or tumor be allowed to remain within the bladder, or a stricture or enlarged prostate causes residual urine to accumulate.

Indication II. *Remove the urine from the bladder and keep it empty.*

In cystitis, if the bladder is able to empty itself completely, the micro-organisms are soon swept away and the attack is over; but, if residual urine is allowed to remain and become stagnant, it affords an excellent culture-medium for the growth of the germs.

The simplest form of drainage of the bladder is by means of a soft-rubber catheter passed once a day or oftener, as needed; but in atonic bladders, or severe cases, this is not sufficient; but the bladder *must be kept empty.*

Permanent catheterization may be employed by passing a catheter into the bladder through the urethra and tying it in, so that the urine is voided as fast as it is secreted by the kidneys. The disadvantages of this method are that after a few days it is apt to excite inflammation of the urethra, epididymitis, urinary fever, or suppression of urine. In consequence of these drawbacks, except in very light cases of cystitis or in the presence of debility which is so great that there is danger in giving an anæsthetic, it is best to drain the bladder through a perineal or suprapubic incision.

Perineal Drainage.—*Technique of Operation.*—A lithotomy-staff is introduced into the bladder through the urethra and an incision is made through the perineum, into the membranous urethra, by thrusting a long, straight bistoury three-fourths of an inch in front of the anus, until its point strikes the groove in the staff. A gorget is introduced into the bladder through the wound and a No. 30 French, soft-rubber catheter carried along it, till its eye lies within the cavity of the bladder.

A silk suture is then passed through the skin of the perineal wound and the catheter, in this way keeping the catheter from being forced out by the contractions of the bladder.

Instead of a rubber catheter, Watson's silver perineal drainage-tube may be used in cases where the bladder is tolerant; but the metal tube is apt to excite more pain than the soft-rubber catheter.

The catheter is attached to a rubber tube whose end lies in a bottle on the floor to receive the urine. In this way the bladder is kept entirely empty, and can be thoroughly cleansed by irrigations.

The length of time during which drainage is to be maintained varies greatly, depending upon the degree of the cystitis. It should be continued until the urine is free from pus and acid in reaction and the muscular walls of the bladder have regained their tone, and this, in a severe case of long standing, may require some months.

Suprapubic drainage is to be preferred to drainage through the perineum, when it is continued for some length of time, as the flow of urine through the abdominal fistula can be received in a rubber bag under the patient's clothing (the Bloodgood bladder-drain) and he can go about and keep dry.

The operative treatment is resorted to only in particularly severe cases, which on account of extreme tenderness make all local means of treatment impossible. Such instances occur in patients with contracted bladders and but little residual urine. They suffer from constant pain and frequent and painful urination, with the discharge of a few drops of ammoniacal urine each time. Again, in inveterate cases of chronic cystitis, where the bladder is atonic and perhaps sacculated, and where bladder-washing and instillations have been used without effect, permanent drainage through a fistula often causes a marked improvement.

Indication III. *Destroy micro-organisms or check their growth and remove pus and fermentation products from the bladder by means of irrigation of the bladder.* Washing the bladder is the most efficient mode of cleansing the bladder-walls of adherent pus, micro-organisms, and urinary salts. The micro-organisms which lie beneath the mucous membrane cannot be reached, but, by lessening the congestion of the mucous membrane and removing decomposed urine, it is put in a condition which favors its recovery.

Although the bladder can be filled by hydrostatic pressure from an irrigator, it requires a catheter to wash it out. The only suitable forms of catheter are the soft rubber and the gum elastic. They should be of large size and provided with two eyes, as the stream flowing through them stirs up the stagnant urine more effectually if it enters the bladder from two directions.

A large hard-rubber syringe holding five ounces may be used, and has the advantage that it is possible to judge of the extent to which the bladder is filled by the feeling of resistance, to the inflowing stream, offered by the muscular walls of the bladder. The successive jets entering also set up contractions of the muscular walls, which have an influence in restoring their tone.

The general custom is to use an *irrigator* raised to the height of two to four feet and attached to the catheter by a short glass connecting-tube. The patient should rest upon a table or sofa in a half-sitting position, and the anterior urethra should be irrigated to cleanse it, before the catheter is carried into the bladder.

As soon as a sense of resistance is perceived or the patient feels pain, the inflow should be stopped, and after a short pause the fluid be allowed to flow out again, and the proceeding repeated until the solution comes away clear. The amount of fluid necessary to flow in at one time is small: 60 to 150 grammes (from 2 to 5 ounces) is enough.

SOLUTIONS FOR WASHING THE BLADDER.

For simply cleansing the walls of the bladder and removing adherent pus and decomposing urine, normal salt solution, 0.6 per cent., or boric-acid water, 4 per cent., in strength, are well adapted to the purpose. Salicylic acid, 3 parts to 1000, has some effect in checking the fermentation process.

On account of the bacterial origin of the cystitis, many various antiseptics have been recommended, but on more extended trials they have proved disappointing and have fallen into disuse.

Nitrate of silver is an exception to the antiseptics just mentioned, and is the most valuable remedy we possess in suppurative cystitis. It should be used in the strength of 1-4000 up to 1-1000 beginning with the weaker and gradually increasing. The solution should be retained in the bladder two or three minutes and then allowed to flow out again. If much pain is caused it may be neutralized by washing afterward with salt solution. The application should be made every two to three days. Permanganate of potash is less useful than nitrate of silver in cystitis, but is occasionally of service.

In chronic cystitis, when the bladder is contracted and much pain is complained of, the distension attendant upon washing the bladder contra-indicates its use, and instillations of nitrate of silver have to be substituted. Twenty drops may be used every two to four days, from gr. v to x in strength.

SPECIFIC CYSTITIS.

GONORRHŒAL CYSTITIS.

Statistics show that the posterior urethra is involved in 80 per cent. of the cases of gonorrhœa, but a true cystitis arising from infection of the bladder mucous membrane with gonococci is extremely rare, although a few cases have been recorded.

Inflammation of the trigone of the bladder frequently occurs during the course of a gonorrhœa, after the posterior urethra has been attacked, and is almost always due, not to the entrance of the gonococci into the bladder, but of some other pathogenic organism, and the infection is therefore of the mixed variety.

Its symptoms, course, and treatment are those of the ordinary forms of suppurative cystitis, and have already been considered under that heading.

TUBERCULOUS CYSTITIS.

Tubercular involvement of the bladder occurs most frequently in young adults between the ages of 15 and 40, although no age is exempt.

MODES OF INFECTION.

Primary infection of the bladder is of rare occurrence, although it is met with occasionally, for, so long as the vesical epithelium is intact, it affords an efficient barrier to the entrance into the tissues of any tubercle bacilli which may have found their way into the bladder. If the mucous membrane has been injured or eroded by the action of ammoniacal urine, the tubercle bacilli can easily enter the tissues. For this reason primary tuberculosis of the bladder is rare, and when the bladder becomes tuberculous it is usually infected from a deposit elsewhere.

Secondary infection of the bladder may result from the direct extension of a tuberculous infiltration of the seminal vesicles or prostate or the bacilli may be conveyed by the lymphatics or blood-circulation from the kidneys or testicle. Most of the cases of bladder tuberculosis, however, originate from the mural transplantation of tubercle bacilli contained in the urine from a tubercular kidney.

PATHOLOGICAL CHANGES.

The tubercular deposit always begins around the vesico-urethral orifice and trigone or around the urethral openings. The process does not last long as a pure tuberculosis, for it is soon complicated by infection with other micro-organisms, causing suppurative cystitis and ammoniacal decomposition of urine.

A *cystoscopic* examination made early in the case shows a few minute papules or pin-head-sized ulcerations, and later in the disease are to be seen irregular-shaped ulcerations covered with a deposit of urinary salts and sloughing material, and the base of the ulcer may be covered with fungating granulations, which bleed easily.

The walls of the bladder in some places become hard and rigid and in others are softened, and its capacity is diminished, so that it may only hold a few ounces of urine. The cellular tissue surrounding the base of the bladder becomes the seat of multiple abscesses, which break and form fistulæ.

SYMPTOMS AND COURSE.

Tuberculosis of the bladder begins insidiously, and often without any apparent cause. Its symptoms are those of cystitis, viz.: frequent urination, pyuria, and hæmaturia. Bleeding is a prominent symptom, appears early in the disease, and is more or less persistent throughout its course.

In the later stages, after suppurative cystitis has made its appearance, the striking symptom is the painful and frequent urination, occasioned by the contraction of the cavity of the bladder and the ammoniacal urine coming in contact with its ulcerated walls. The endeavor to rid the bladder of the irritating urine causes straining every few minutes, which is accompanied by intense pain. The kidneys are, after a time, infected, and become the seat of abscesses. Abscesses and fistulæ form around the base of the bladder, and the patient dies from exhaustion induced by the incessant pain and the septic fever.

DIAGNOSIS.

Tuberculosis should always be suspected when a young man of tubercular heredity develops a cystitis without any apparent exciting or predisposing cause, which runs a very persistent and intractable course, and is not cured by the ordinary treatment.

The *cystoscope* should be used with extreme precautions to avoid causing an infection of the bladder with pus-organisms. It may show tubercles in groups or disseminated, or ragged, punched-out, irregular ulcers.

A *microscopic* examination of the pus from the bladder confirms the diagnosis by disclosing tubercle bacilli. There may be difficulty in finding the bacilli, even after centrifugating, as they are often scanty. If none are found, the sediment may be injected into the subcutaneous tissues over the abdomen of a guinea-pig. If the animal is killed four weeks later, and the lymph-glands are tubercular or tubercular nodules are disseminated throughout the body, the diagnosis is established.

A careful search should always be made for tubercular foci in neighboring organs, and nodules may usually be found in the prostate, seminal vesicles, or epididymis.

Tubercular involvement of the kidney often exists and is overlooked. The symptoms are not marked; there is an absence of renal pain and colic and no tenderness on pressure. It may be suspected, however, when the urine is persistently of a low specific gravity and acid in reaction, and when the pyuria is intermittent in character, and the amount of pus is greater than could be furnished by the ulcers in the bladder.

If the cystoscope shows a tubercular ulceration about the mouth of one ureter, it is an evidence that the kidney on that side is affected; but the point can only be definitely determined by catheterizing the ureters or making use of Harrison's rectal segregator and examining separately the urine from each kidney.

PROGNOSIS.

The prognosis in tuberculosis of the bladder is always grave, and recovery is exceedingly rare, but the disease may remain latent for years unless complicated by infection with pyogenic micro-organisms. This hastens the process; the kidneys are liable to become tubercular, and the bladder grows rapidly worse.

TREATMENT.

The attempt has been made by Guyon, Reverdin, and others to cure vesical tuberculosis in its earliest stages by opening the bladder suprapubic and curetting out the ulcers.

The resort to surgical measures in the beginning of tuberculosis of the bladder, in the hope of curing the disease, is to-day practically abandoned. The bladder infection is almost always secondary to tubercular deposits in other organs which are out of reach, and surgical interference in the majority of cases only increases the rapidity of the course of the disease.

In incipient tuberculosis of the bladder the indication for treatment consists in improving the vitality of the tissues, and to this end life in the open air or a long sea-voyage is the best measure.

Under this *régime* patients often improve and a few recover. After suppurative cystitis and pyelitis have set in, no benefit is to be derived from leaving home.

Creasote and carbonate of guaiacol are recommended by some authorities, and by others are considered of no avail.

Local treatment is harmful, as a rule. The tubercular deposits cannot be reached, and there is danger, in bladder-washing and instillations, of introducing pus-organisms and causing suppurative cystitis. After this has occurred, the instillation of corrosive sublimate (Guyon), using 20 drops of 1 to 5000 solution and increasing up to 1 to 1000, are often of marked benefit. The reaction following is rather severe, and may last five to six days, and should be allowed to subside before repetition. After the reactive symptoms have passed away, the pain of urination is lessened and the intervals between the acts are prolonged.

Nitrate-of-silver instillations are irritating, and aggravate the inflammation. This is so notably the case that a violent reaction following the use of nitrate of silver in a case of cystitis suggests that it is tubercular in origin.

Later in the disease, when the pain and frequency of urination become unbearable, morphia is the only means of relieving the suffering.

As time goes by and opium fails to control the tenesmus and frequent micturition, **permanent drainage of the bladder through a fistula** should be established. This is not successful in relieving the difficulty entirely, but is the last refuge for the relief of the intense suffering. The suprapubic opening is to be preferred, as the apparatus for receiving the urine can be more easily applied and the patient is not long confined to bed, but can be up and about.

At the time of operation the bladder may be inspected, and if a few isolated tubercular ulcers are found they can be removed with the curette or Paquelin cautery and iodoform rubbed into the spots.

The subsequent healing of the ulcers has a favorable influence upon the pain and tenesmus, and the permanent fistula in the bladder affords an opportunity for the complete and painless evacuation of ammoniacal urine and pus, and also admits of its cavity being kept clean by irrigations, and the congested mucous membrane can also be medicated by instillations of corrosive sublimate or nitrate of silver.

When the bladder cavity is very much contracted and its walls are thick and rigid, suprapubic cystotomy cannot be so readily performed, and permanent drainage through a fistula in the perineum has to be resorted to.

There is always the danger, in establishing an artificial fistula, that the wound itself may be infected and become the seat of a tubercular infiltration, increasing the extent and rapidity of the progress of the disease. The perineal wound is much more liable to infection than the suprapubic opening, and should only be used when the suprapubic fistula is impracticable.

BACTERIURIA.

This condition is characterized by the quantities of bacteria which are found growing in the urine, which is entirely free from pus. The mucous membrane of the bladder is perfectly healthy and the infection is confined to the urine alone.

On inspection the urine appears turbid and of a whitish-yellow color, and the odor is very disagreeable, resembling stale fish or fæculent material.

On centrifugating, and examining the sediment microscopically, it is found to be composed of the bacillus coli communis in enormous quantities. Pus and epithelial cells exist in very small numbers.

It is often impossible to trace the manner in which the bacteria gain access to the bladder, although in most of the cases reported there has been a condition of hæmaturia, enlargement of the prostate requiring catheterization, stricture, or recent gonorrhœa, and in women a recent inflammation of the pelvic organs. It is therefore supposed that the bacteria enter the bladder (*a*) through the urethra, (*b*) with the urine from the kidneys, (*c*) from the general blood-current, or (*d*) from adjacent organs through the lymphatics, although their place of proliferation is not discoverable.

SYMPTOMS.

The symptoms of bacteriuria are not marked, and the turbid urine with a foul odor is often the only sign.

Sometimes the urination is frequent and urgent, and accompanied by a burning pain in the urethra, and rarely a chill followed by fever, which resembles urinary fever in its onset and course, is noted.

COURSE.

The course of the disease is variable, occasionally brief and transient, sometimes more protracted, with remissions alternating with exacerbations, and it often becomes chronic, lasting for years.

PROGNOSIS.

The prognosis is rather unfavorable as regards a cure, unless the place of bacterial growth is accessible. If this is not the case, the bacteria are apt to remain permanently in the urine, but the general health does not suffer and the urinary organs remain in a healthy state.

DIAGNOSIS AND TREATMENT.

The diagnosis can only be made by excluding cystitis and finding the bacteria in the urine with the microscope.

The treatment consists in first removing any possible source of growth for the bacteria by relieving habitual constipation or enteritis. If the breeding-place of the micro-organisms is in some local condition, such as a posterior urethritis or stricture, it should be removed.

When no cause is discoverable, the administration of urinary antiseptics internally,—salol, methyl-blue, and Urotropin,—in order to destroy the bacteria, is called for. The patient should drink freely of pure distilled or spring- water in order to mechanically wash out and remove the fermenting contents of the bladder.

Bladder-washing with solution of nitrate of silver or sublimate is, in general, of little use, and still at times it may be of some value.

TUMORS OF THE BLADDER.

The new growths which occur in the bladder may be either **benign** or **malignant.** The benign tumors, or papillomata, appear in different forms: (*a*) As villous polypi, composed of loops of blood-vessels, which grow and project into the cavity of the bladder in long, waving strings, and (*b*) fibro-papillomata, which are pedunculated tumors of a firmer consistence.

Malignant Tumors.

Primary cancer of the bladder is exceedingly rare, but secondary deposits are not infrequent. The *forms* in which it presents are as sarcoma or carcinoma, which is either epithelial or the glandular-celled variety.

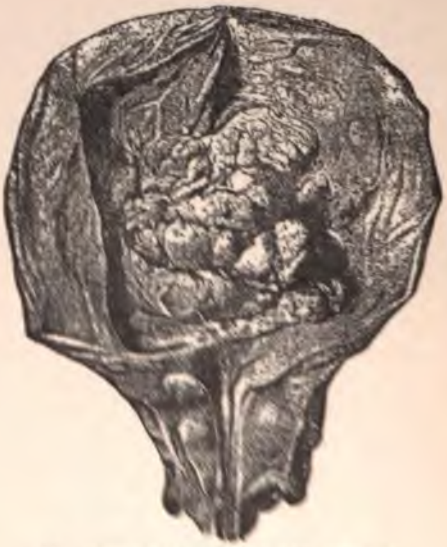

Fig. 49.—Carcinoma of the Bladder.

They are less apt to be polypoid in appearance, but are spread out, *infiltrating* the tissues. The surface is covered with granulations or villosities, and in the later stages is ulcerated and presents gaping ulcers. The tumors are often multiple and their development is slow.

Both benign and malignant forms of growth are usually located in the region of the trigone or near the openings of the ureters.

Tumors of the bladder predispose to cystitis, which in time leads to disease of the kidney, either suppurative pyelitis or hydronephrosis, or death may occur from the constantly recurring hæmorrhages.

If cancer of the bladder is primary, it is not apt to affect distant organs.

Vesical calculus is a frequent complication of new growths in the bladder from a deposit of the urinary salts upon the ulcerated bladder-wall or upon a piece of necrotic tissue separated by sloughing.

SYMPTOMS.

Hæmaturia is the most prominent symptom of tumor of the bladder. It comes on suddenly and without provocation, and may last a few hours or for some weeks. The quantity of blood lost is variable and fluctuating. At one time it may be abundant and upon the next urination the water may be almost clear.

Frequency of urination and tenesmus are often present in the later stages, and depend upon the cystitis, or are due to infiltration of the trigone and vesical neck by a malignant growth. Pain is never a prominent symptom, and when it occurs it is occasioned by the cystitis.

DIAGNOSIS.

The presence of a tumor due to malignant disease may often be felt by *palpation*, placing one finger in the rectum and making counter-pressure over the pubes with the other hand.

Any thickening of the trigone can be appreciated by introducing a sound into the bladder and feeling the thickness of the tissue which lies between the sound and the finger in the rectum.

Polypoid growths are not capable of being made out by palpation.

The cystoscope is not always available, on account of the amount and rapidity of the hæmorrhage obscuring the medium; but when it is possible to use it a definite diagnosis of the conditions can be made by an experienced observer.

Cystotomy, either perineal or suprapubic, with digital exploration or inspection of the bladder, affords the means of making a positive diagnosis.

The suprapubic opening is to be preferred, because if a tumor is present it can be removed more readily than through a perineal wound.

PROGNOSIS.

Benign tumors, if let alone, may cause death either from the repeated hæmorrhages or from pyelonephritis following cystitis. They can be readily removed by operation, but are apt to grow again.

Malignant tumors are difficult to remove completely, as they infiltrate the bladder-wall and are liable to recur. Authorities give the duration of life at from two to three years after the commencement of the disease.

TREATMENT.

The hæmorrhage is sometimes controlled by hot injections of alum, ʒiv to the pint; fluid extract of hydrastis, ʒij to the pint; or acetanilid, ʒij to the pint.

Clots retained in the bladder, if moderate in size, may be let alone, as they will soften and be passed naturally.

If the bladder should become greatly distended by retention of urine, the clots may be withdrawn by a large catheter and suction syringe or a litholapaxy evacuating tube and aspirator.

If the bleeding continues and is persistent, suprapubic cystotomy should be performed without further delay. The suprapubic opening affords an opportunity for inspecting the interior of the bladder, and through it the tumor may be removed.

Polypoid growths are best treated by cutting through the mucous membrane at their bases, removing the whole tumor, and sewing up the incision with catgut sutures, or they may be removed by crushing or twisting off with forceps or by the sharp spoon, or they may be burned off with the Paquelin cautery or the galvano-caustic loop.

Infiltrating growths, which are always malignant, cannot be removed by these means, but require the complete extirpation of the portion of the bladder-wall upon which they are located.

If the tumor should be found too extensive for removal, the suprapubic opening should be maintained as a means of permanently draining the bladder of decomposing urine and blood-clots.

CHAPTER XII.

VESICAL CALCULUS.

THE stones which form in the bladder are classified, according to their composition, into three varieties:—

(a) **Uratic calculi,** which are made up of uric acid and urates. They form about three-fifths of the total number of calculi, and are the softest of any in their consistence.

(b) **Oxalic calculi** are composed of oxalate of lime. They occur less frequently than the others, the estimated proportion being about 3 per cent. They are the hardest and heaviest of all the varieties, and are usually studded with numerous projecting nodules, from which they derive the name of **mulberry calculi.**

(c) **Phosphatic calculi** are formed from phosphates and carbonates, which are often combined with urate of ammonia. Phosphatic stones are not so hard as the oxalic, but harder than the uratic stones. They are never due to constitutional or diathetic conditions, but are always the result of cystitis and decomposing urine, from which the salts are deposited and agglutinated together by the pus.

Stones composed of a single element alone are rarely met with. As a rule, two or more elements are found together, arranged in concentric layers around the nucleus.

The formation of a calculus is not a simple process of a deposit of salts, and it is a common occurrence for urine to contain crystals of uric acid, oxalates, or phosphates for a long time without the formation of a stone; but in the presence of albuminoid material these crystals change their molecular form, and gain a tendency to coalesce and adhere to each other and also to a sort of frame-work composed of colloid material, which is furnished by the pus.

The practical deduction to be drawn from this fact is that, while crystals may be present in the urine for years without the formation of a stone, a cystitis producing pus gives the necessary stimulus to coalescence, and a stone is very liable to form.

NUMBER.

Stones are usually single, although very frequently they are multiple; sometimes five or six may be present, and instances are on record where three or four hundred stones were taken from the bladder.

It occasionally happens that a single stone becomes multiple through a process of **spontaneous fracture.**

It has been found in laboratory experiments that, if a calculus formed in a solution of gum were placed in a solution of a different specific gravity, it would split up into segments. Hence it is probable that the instances reported of the spontaneous fracture of stones in the bladder, which have been accredited to different mineral or spring-waters, is due to the effect produced upon the stone by surrounding it with urine whose specific gravity and reaction have been changed from their original state at the time of formation of the stone by the ingestion of large quantities of water. The albuminoid material forming the frame-work of the stone absorbs fluid and swells, bursting apart the laminæ of the stone and so fracturing it into segments.

ETIOLOGY.

For a calculus to form, it is absolutely essential that there should be a foreign body in the bladder, since the crystals must have a *nucleus* around which they may coalesce and adhere.

The nucleus may be a foreign body introduced from without, such as a broken catheter- or pipe- stem, pin, etc., or it may be a small piece of necrotic tissue which has been sloughed off from the bladder-wall.

In many cases of stone, however, the nucleus is composed of uratic crystals. These become agglomerated in the kidney and pass through the ureter, causing renal colic. They drop into the bladder, and, if they are not voided through the urethra, form a nucleus.

Predisposing Causes of Uratic and Oxalic Calculi. — As these stones are dependent upon a constitutional or diathetic state, certain things which influence the general condition of bodily health play an important rôle in their formation.

It has been generally supposed that the habitual drinking of water impregnated with the salts of lime was very apt to occasion vesical calculus. Investigations to determine this point show that the cases of calculus are not equally distributed through the limestone districts, and that they are just as common in the adjacent regions where the water is free from lime, and on these accounts the limestone theory has been abandoned.

Diet and constitutional habit, however, are important factors in the production of stone, since the excretion of uric and oxalic acids

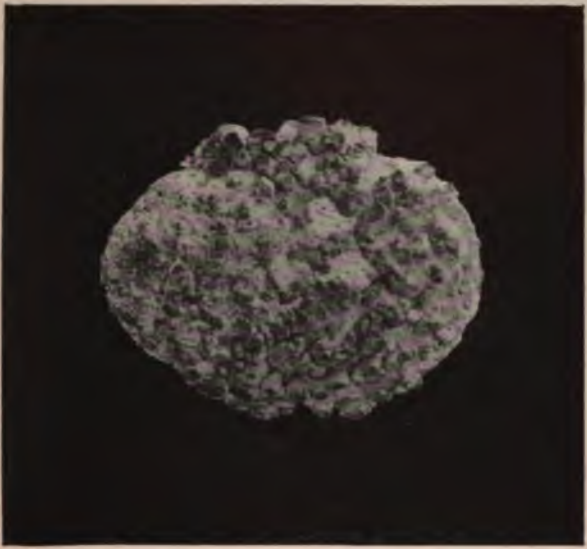

Fig. 50.—Oxalic or Mulberry Calculus. (Author's Specimen, from Kings County Hospital.)

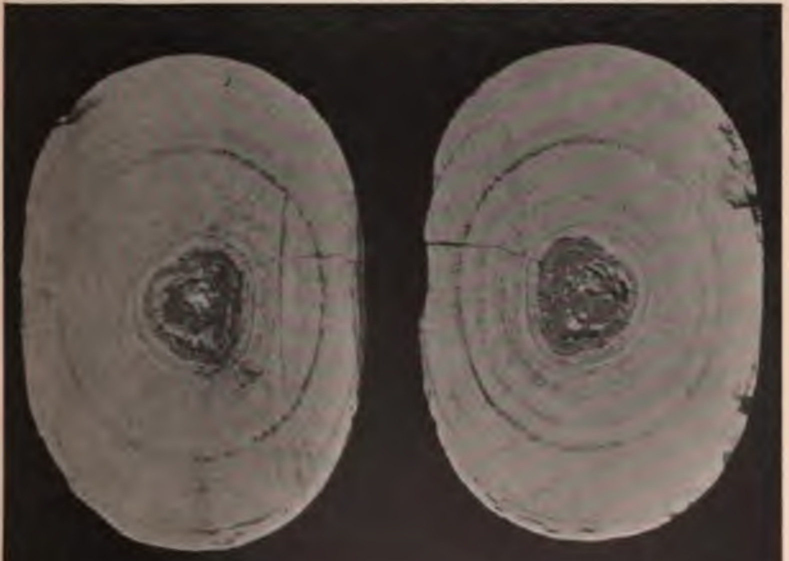

Fig. 51.—Vesical Calculus, split in two Halves, showing mode of formation, by a deposit of Phosphates in Concentric Layers, around a Uric-Acid Nucleus. Weight, 1370 Grains. (Author's Specimen, from Kings County Hospital.)

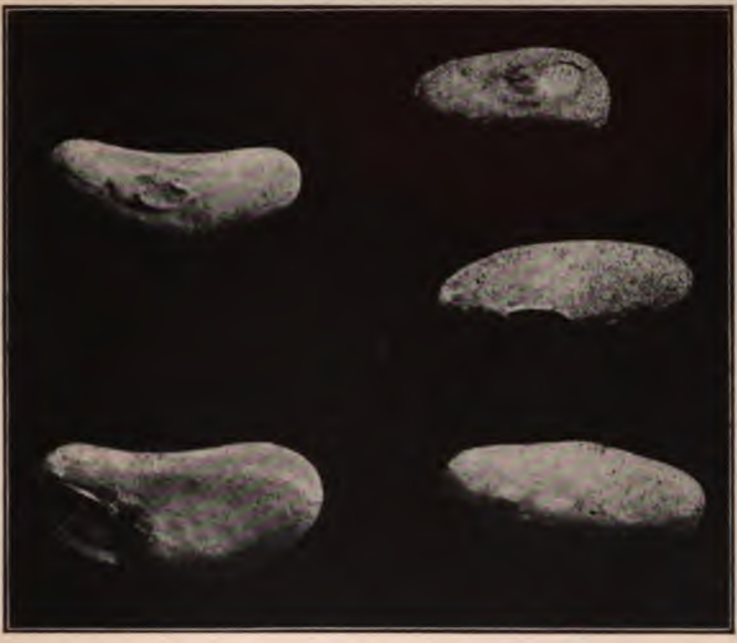

Fig. 52.—Multiple Phosphatic Calculi, removed by Suprapubic Cystotomy from same Patient. (Author's Specimen, from Kings County Hospital.)

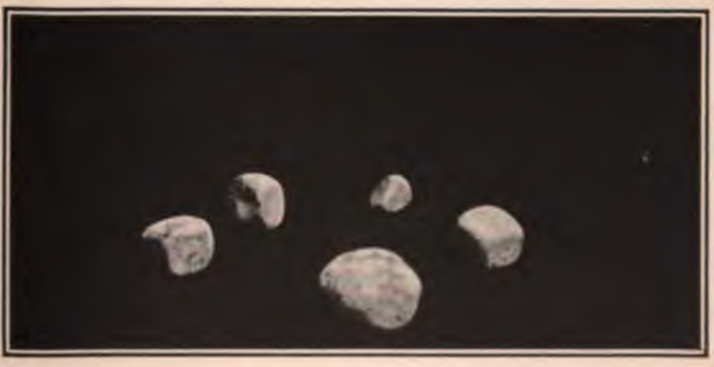

Fig. 53.—Calculi which formed in the Bladder as a Single Stone, which underwent Spontaneous Fracture. Afterward fragments passed into the Prostatic Urethra, where they became impacted, and were removed by External Urethrotomy. (Author's Specimen, from Kings County Hospital.)

depends upon the quality of the food and the diathesis. On this account children with feeble digestive powers, who eat largely of nitrogenous food, are unable to perform the processes of oxidation completely, and the results of the retrograde metamorphosis of the tissues are eliminated, not as urea, which is freely soluble, but as urates or oxalates.

The same is also true of adults, who eat more nitrogenous food than they require, use alcohol and malt liquors freely, and take but little exercise. Such persons are subject to attacks of gout or various manifestations of lithæmia, which are included under the term of gouty diathesis.

The gouty diathesis is notably an inherited condition, and on that account different members of successive generations of a family are liable to develop oxalic or uratic stone in the bladder or some other gouty manifestation.

Phosphatic stones are not constitutional in their origin, but are dependent upon purely local causes. They result in consequence of urine decomposing and throwing down crystals of the triple phosphates, which are glued together by muco-pus, and form nuclei, around which crystallization goes on rapidly.

On this account any obstruction which prevents the bladder from emptying itself—such as stricture, hypertrophied prostate, and paralysis—allows residual urine to accumulate, and, if cystitis occurs, alkaline fermentation of the urine, deposit of crystals, and stone-formation result.

SYMPTOMS.

While it is possible for a small stone to exist for years without producing marked symptoms, and particularly so if it lie in the pouch behind an enlarged prostate, it is usual for a stone in the bladder to give rise to the following prominent symptoms: (*a*) pain, (*b*) increased frequency of urination, (*c*) blood, and (*d*) sudden stoppage of urine in full stream.

The pain is referred to the head of the penis under the glans, and shoots into the perineum and down the thighs.

It is felt especially at the end of urination, for, as the last few drops of urine are expelled, the muscular contractions of the bladder drive the stone forcibly into its neck, causing a contusion.

The pain is increased by riding in a jolting wagon, by going downstairs, or even by walking.

Increased frequency of urination occurs through the day, when the patient is about on his feet and the stone is moving in the bladder. At night, when the individual is quiet in bed, the stone does not move, and the intervals between urination are longer.

Blood never appears in any large quantity in the urine, but a few drops are squeezed out at the end of urination, or it may be mixed with urine, giving it a smoky color. It is not a constant symptom, but intermittent.

Sudden stoppage of the urine in full stream is a very characteristic symptom, when it is present, and is caused by the stone being carried into the vesical outlet, obstructing it and shutting off the flow of urine like a valve.

It is rarely observed in old men with enlarged prostates, as the stone lies in the deep posterior prostatic pouch.

Cystitis always exists when a stone is present, and the symptoms of calculus are complicated by those of inflammation of the bladder.

DIAGNOSIS.

The clinical history of stone is merely suggestive of the condition, but to make a positive diagnosis the stone must be touched with an instrument or through an incision in the bladder or seen with the cystoscope.

Examination with Thompson's Searcher, or Sounding for Stone.—The patient should lie on his back, and with old men it is desirable to elevate the hips so that the stone may roll out of the post-prostatic pouch. The bladder should contain from four to six ounces of sterilized water, in order to distend its folds and allow the beak of the searcher to move freely.

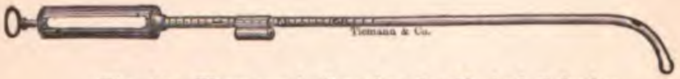

Fig. 54.—Thompson's Searcher for Vesical Calculus.

The searcher is introduced after the manner of a sound, and the trigone and post-prostatic pouch should be examined by turning the beak of the searcher from side to side and rotating it behind the prostate, as the stone always lies in the most dependent portion of the bladder.

If the stone is not touched, the fluid in the bladder should be allowed to flow out through the hollow shaft of the searcher, and, as the bladder collapses, the stone is often brought up against the point of the searcher and the impact can be felt.

There are certain precautions to be observed in sounding for stone. The patient's genitals should be cleansed and the instruments must, of course, be sterile. Children should always be examined under chloroform, as otherwise they would be restless, and the bladder might be wounded by a sudden movement.

In old men there is a great deal of danger of urinary fever. They should be examined at home and kept in bed from twenty-four to forty-eight hours after the examination. It is always desirable to administer salol or Urotropin for two days before searching.

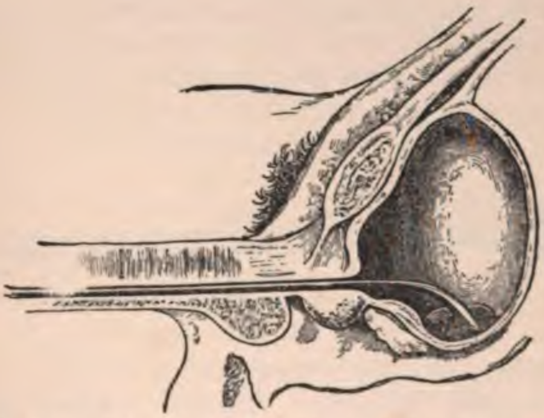

Fig. 55.—Searching for Stone Lying in the Post-prostatic Pouch.

If there is a strong suspicion of the presence of a stone, it is advisable to make all the preparations for immediate operation, in order to avoid the reaction which so often follows an examination of the bladder.

The presence of a stone is perceived by the searcher and gives rise to a sharp click, which can be felt and heard. Soft stones give a dull or muffled sound when touched, but the sound is sharper in character when a hard stone is struck.

The size of a stone may be measured by grasping it between the jaws of a lithotrite; but the determination of the *size* or *number* the stones is difficult with the searcher, and for this purpose the **cystoscope** is of great value.

With this instrument it is possible to see the stones distinctly, unless the bladder is bleeding freely, and their size, shape, and location can all be accurately ascertained.

Phosphatic stones are white and round, uratic stones are yellowish and oval, and oxalic concretions are dark and covered with bosses and sharp points; but it should be remembered that most stones are composed of different elements arranged in concentric layers. At the same time the position of the stone may be ascertained, for a stone lying in a deep pouch behind an enlarged prostate or attached to the bladder-wall as an incrustation or lying in a saccular dilatation will often be out of reach of a searcher, and may be overlooked.

An examination of the urine often throws light on the character of the stone by revealing the predominant form of the urinary crystals.

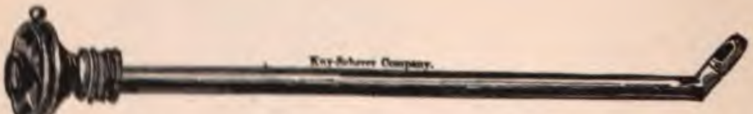

Fig. 56.—Nitze's Observation Cystoscope.

The litholapaxy pump is sometimes useful in detecting a small stone which eludes the searcher. The tube is introduced and water forced into the bladder with the bulb. The outflow of the water forces the stone against the orifice of the tube, and the click is appreciable to the ear and to the touch.

Since the introduction into practice of the cystoscope the **exploration of the bladder through a suprapubic or perineal wound** is rarely called for.

In former times it was often necessary in doubtful cases, particularly in the instance of a calculus lying in a saccular dilatation or in the presence of an incrustation of the bladder-wall with urinary crystals.

PREVENTIVE TREATMENT.

The presence of crystals in freshly-voided urine which is still warm should be regarded as an indication that calculus is liable to form, and the tendency to the formation of *uratic and oxalic stones* should be guarded against by attention to the patient's general health. He should be cautioned against using an excess of nitrogenous food, sugar, or fat. It is in general thought best not to cut off all the nitrogenous food, but to allow a general diet, with a reduction of the accustomed quantity of meat.

Moderate and systematic daily exercise in the open air is of great assistance in favoring oxidation.

The ingestion of large quantities of pure spring- or distilled water has the effect of diluting concentrated urine, rendering soluble its contained salts, and flushing out the kidneys.

If the urine is strongly acid, citrate of potash is indicated in order to render it neutral.

If phosphates are abundant and due to imperfect assimilation, the mineral acids, particularly phosphoric, in doses of *m*xv three times a day, and the vegetable bitters improve the digestive powers. The phosphaturia often disappears for a time and sometimes permanently under the use of Urotropin, gr. viij three times a day, or benzoic acid.

The adoption of local measures for preventing the formation of **phosphatic calculi** is much oftener crowned with success.

As these stones are always caused by the decomposition of alkaline urine in the presence of cystitis, the indications are (*a*) to drain the bladder by removing a stricture, if present, and evacuating residual urine, in cases of enlarged prostate or atony and distension of the bladder in paralytics, and (*b*) to cure the existing cystitis by bladder-washing.

In this way the decomposition of urine is checked and the precipitation of phosphates and carbonates ceases.

Attempts to dissolve stones after their formation have been made for many years, but, while some have been moderately successful in the laboratory, no method has yet been found which is capable of dissolving a stone in the bladder.

The various waters from mineral springs which have derived some reputation as solvents owe it to the fact, already spoken of, that in a few extremely rare instances *spontaneous fracture* of the stone occurs when the specific gravity of the fluid surrounding it is altered.

OPERATIVE TREATMENT.

Litholapaxy, or crushing the stone and immediately washing out the fragments from the bladder, is the operation of choice in all cases of vesical calculus.

It is a prerequisite of the operation that: I. The lithotrite and evacuating catheters should be introduced easily and without wounding the urethra or prostate. In children under sixteen years of age litholapaxy is regarded by many surgeons as inadmissible on account of the small size of the bladder and urethra.

It is advised, however, by others whenever the urethra is large enough to admit the instruments.

II. The stone must be *movable in the bladder*, of *moderate* size, and *not too hard.*

If a stone lies in a saccular dilatation or is adherent to the bladder-wall, it cannot be crushed. Very large stones form such a great quantity of *débris* after crushing that the operation of washing out becomes too protracted.

The *contra-indications* to litholapaxy are (*a*) extreme prostatic hypertrophy. The prostate may be so much enlarged that the lithotrite cannot be introduced, or, even if passed into the bladder, it cannot reach and grasp the stone as it lies in the post-prostatic pouch.

(*b*) Tight stricture of the deep urethra. Such a narrowing of the urethra will prevent the passage of the instruments, and requires external urethrotomy for its cure, and, at the same time, the stone may be removed through the perineal wound, although if very large it may have to be crushed with a lithotrite first.

(*c*) Severe cystitis which does not yield to ordinary treatment. In this condition it is better to remove the stone through an incision, which will subsequently serve for the prolonged drainage of the bladder and at the same time afford an opportunity for its irrigation.

(*d*) Contracted and irritable bladder does not admit of sufficient distension, and is too intolerant of instruments to allow the stone to be crushed.

(*e*) Nephritis and suppurative pyelitis, since uræmic coma and death follow litholapaxy, when the kidneys are diseased, more frequently than after the cutting operations.

Technique.—The patient, with his rectum previously emptied, is anæsthetized, lying upon his back. The hips are elevated, to allow the stone to roll out of the post-prostatic pouch.

The bladder is washed out and filled with six to eight ounces of boric-acid solution.

The lithotrite is passed through the urethra after the manner of a sound, and rests on the floor of the bladder behind the prostate, with its beak pointing upward. The lithotrite, from its weight, sinks in and forms a depression in the wall of the bladder. Ordinarily the stone lies alongside the beak of the lithotrite, and when the ja are opened it rolls in between them. The jaws are closed an

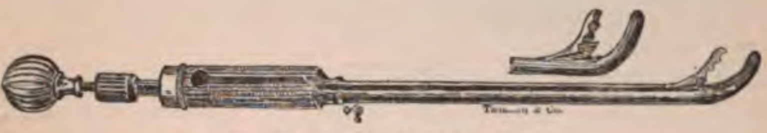
Fig. 57.—Bigelow's Lithotrite.

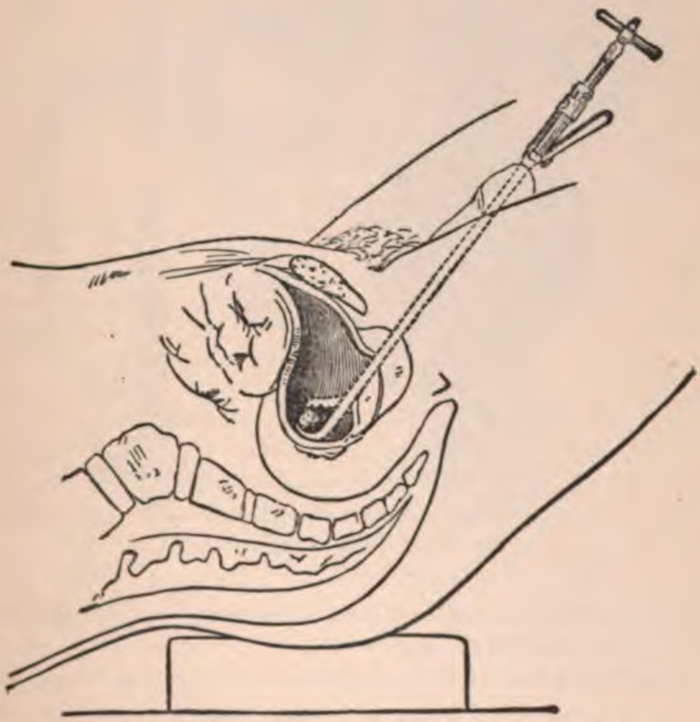
Fig. 58.—Method of Grasping the Stone in Lithotrity.

stone is felt to be grasped. If the jaws fail to seize the stone, the blades are opened in the upright position, turned over on one side, and shut along the floor of the bladder. If the stone is not found, the manœuvre is repeated in the opposite direction.

If the stone lies in a deep post-prostatic pouch, raising the patient's hips may roll it out within reach, or it may be pried up by a finger in the rectum.

In the event of these failing, the jaws of the lithotrite may be turned so as to point downward, in the hope of seizing the stone as it lies; but in this case there is always danger of nipping and cutting out a piece of the bladder-wall.

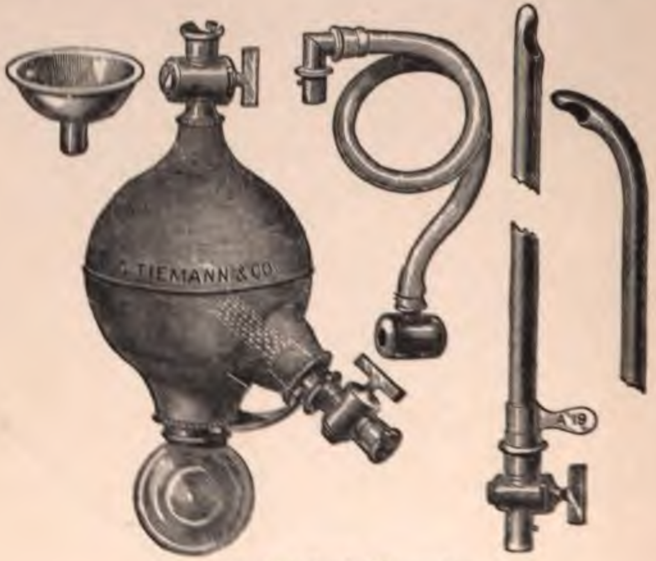

Fig. 59.—Bigelow's Evacuator.

When the stone has been caught between the jaws, the resistance it offers is easily felt on approximating them. The blades of the lithotrite are then locked, and by turning the handle the jaws are screwed together, comminuting the stone into fragments. The manœuvres of opening the jaws, catching the stone, and breaking it are repeated till the surgeon perceives that no large fragments are left, and the lithotrite is withdrawn.

The next step is the *evacuation of the débris*. The evacuating tube is introduced into the bladder and its contained fluid allowed to flow out with a gush, carrying with it some of the fragments. The bladder is then filled with water by pumping in the contents of the bulb, and the fluid then flows out again into the receiver, carrying more fragments. The pumping is continued till no more fragments come away, and auscultation over the bladder fails to perceive the click of a fragment remaining behind which is too large to enter the tube. If this is the case the lithotrite should be introduced again and the piece crushed and pumped out.

The after-treatment consists in keeping the patient in bed and allowing him to drink freely of water, to keep the kidneys active.

If retention of urine occurs, it is well to tie a catheter in, in order to avoid the irritation of its frequent passage.

After ten days have passed the bladder should be pumped once more to remove the sand and mucus which is left and which might serve as a nucleus for another stone, and the entire absence of fragments should be verified by a cystoscopic examination.

Mortality of Litholapaxy.—The following statistics, compiled by Cabot, show the death-rate at different times of life:—

Children under 14, 241 cases, with 4 deaths = 1.66 per cent.
Adults, 14 to 50, 400 " " 13 " = 3.25 " "
Old men, 433 " " 26 " = 6 " "

Perineal Lithotomy.—Until within a few years, and before the technique of litholapaxy and suprapubic lithotomy was perfected, the only way of removing a stone was through a perineal incision.

At the present time the perineal operation has fallen into almost entire disuse, except in children. It offers the advantage of good drainage for the bladder, but its disadvantages are hæmorrhage, which is difficult to control, and the bruising and laceration of the tissues caused by dragging the stone through a small incision, which leads to infection and sloughing. For these reasons the mortality is higher with stones over 1 $^{1}/_{4}$ inches in diameter after the perineal operation than following suprapubic lithotomy.

Perineal lithotomy is particularly dangerous in old men with enlarged prostates, and should not be undertaken without some urgent reason.

It is also difficult to reach a stone from the perineum when the prostate is very much enlarged, on account of the increased length of the perineal distance. Before the fifty-fifth year a small stone can be removed with greater safety through a median perineal incision than by suprapubic lithotomy, but ordinarily such cases are better treated by litholapaxy.

The indications for **median perineal lithotomy** may be tabulated as follows:—

(*a*) Small stones of not more than $1\,^{1}/_{4}$ inches in diameter, complicated by stricture of the urethra, which demands external urethrotomy.

(*b*) Small stones in the presence of atony of the bladder with no expulsive power, and chronic cystitis, provided that the prostate is not very much enlarged.

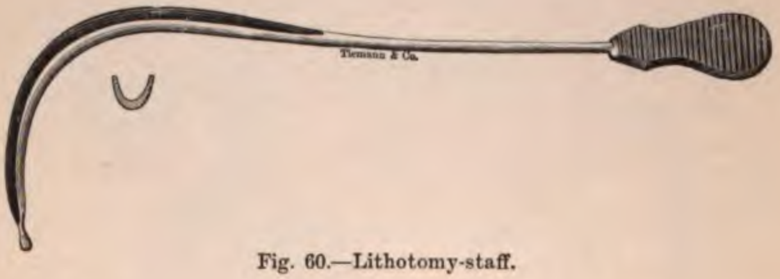

Fig. 60.—Lithotomy-staff.

(*c*) Contracted and irritable bladder, which does not admit of sufficient distension for suprapubic cystotomy and is too intolerant to allow litholapaxy.

Perineal Lithotrity.—Reginald Harrison has enlarged the scope of median lithotomy by devising a lithotrite which is introduced through a median incision and by which stones of considerable size can be crushed in the bladder and removed through the perineal wound.

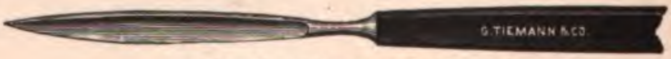

Fig. 61.—Lithotomy-knife.

Perineal Lithotomy.—Technique.—(*a*) *Median Operation.*—This is simply a *boutonnière*, or external urethrotomy, and is performed by introducing a grooved lithotomy-staff through the urethra into the bladder.

The staff is held steadily by an assistant and the surgeon makes a direct thrust or stab with a long, straight bistoury, an inch and a half in front of the rectum, through the tissues lying in front of the urethra, and strikes the groove in the staff. A gorget is then slid along the groove until it enters the bladder, which is explored by means of the finger. If a stone is found it is grasped by the stone forceps and withdrawn, if not too large.

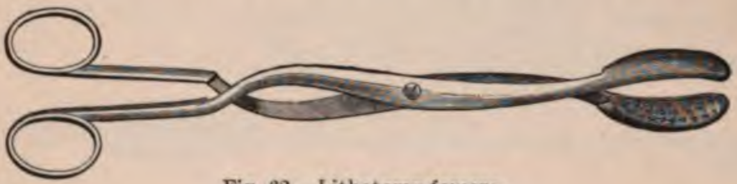

Fig. 62.—Lithotomy-forceps.

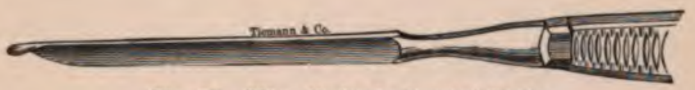

Fig. 63.—Blizard's Probe-Pointed Knife.

If the stone prove too large to pass through the wound, (*b*) *perineal lithotrity* may be performed by introducing Harrison's lithotrite, crushing the stone, and either extracting or pumping out the fragments with a litholapaxy evacuator.

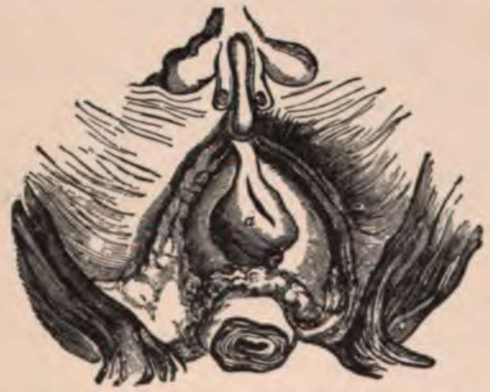

Fig. 64.—Incision Through the Urethra and Prostate in Lateral Lithotomy.

The operation may, if desired, be converted into (*c*) *lateral* *perineal lithotomy*, which was the operation formerly used exclusively in all cases of stone. A Blizard knife is slid along the groove in the staff, as it rests in the bladder, until the point of the knife has entered the bladder. The knife is then withdrawn, making a sweeping cut, outward, downward, and a little to the left, enlarging the original median incision and cutting through the left lobe of the prostate, the perineal muscles, and the skin.

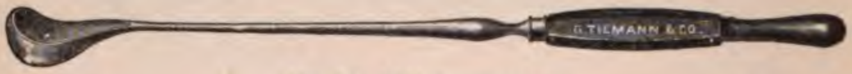

Fig. 65.—Lithotomy-scoop.

In this way the incision is made of sufficient size to permit the extraction of large stones with the forceps or scoop; but, on account of the drawbacks of hæmorrhage and laceration of the tissues, this form of lithotomy is rarely used at the present time.

After-treatment of Perineal Lithotomy. — The wound is never sewed, but is left to heal by granulation. Hæmorrhage is inconsiderable after the median operation, and is easily controlled by a gauze packing around a large soft-rubber catheter. It is often very severe after a lateral lithotomy, and often requires the use of the shirted cannula to hold it in check.

The *mortality of perineal lithotomy* has been tabulated by Freyer and Rosenthal, as follows:—

Deaths before the 20th year......	5 to 8 per cent.
" in adults	10 " 15 " "
" above the 40th year......	32 " 39 " "

These figures refer, in the main, to the operation of lateral lithotomy, and apply less to median lithotomy or lithotrity.

Suprapubic Lithotomy. — Suprapubic lithotomy was first performed in the year 1550 by Pierre Franco, but did not gain favor until 1880, when the application of aseptic methods and improvements in the technique of the operation reduced the previously high rate of mortality.

At the present time, in the cases where litholapaxy cannot be applied and a cutting operation must be employed, suprapubic lithotomy is, under most conditions, the operation of choice.

The advantages of suprapubic over perineal lithotomy are:—

(*a*) The suprapubic operation admits of complete inspection and evacuation of the bladder.

(*b*) Wounding the ejaculatory ducts, neck of the bladder, and rectum, and dangerous hæmorrhage from incised blood-vessels are avoided.

(*c*) The laceration and bruising of the tissues, which occurs when a *large* stone is dragged through a perineal wound, are avoided.

(*d*) The bladder is rendered easy of access, while in the presence of a considerable degree of prostatic hypertrophy the perineal distance is so much increased that it may be impossible to reach the bladder from below.

The special indications for suprapubic lithotomy have been tabulated as follows:—

(*a*) Very large stones, even though they be soft. (*b*) Large, hard stones. (*c*) All fixed stones, incrustations of the bladder-wall, sacculated stones, etc. (*d*) Cases where a high degree of prostatic hypertrophy exists which prevents the seizure of the stone by the lithotrite.

The technique of the operation is based upon the anatomical fact that, when the bladder is filled, the fold of peritoneum, which lies in front of it, is raised up two inches above the pubes, leaving a space, called the space of Retzius or prevesical space, *uncovered by peritoneum*, through which the bladder-wall may be safely incised.

Technique.—The India-rubber bag which was used in the earlier operations for distending the rectum, and so bringing the bladder nearer to the abdominal wall, is rarely, if ever, employed at present. The Trendelenburg posture is only exceptionally required.

A catheter is introduced through the urethra and the bladder is filled with from eight to twelve ounces of sterilized water by means of a syringe. Helferich and Bristow use air for this purpose.

The catheter is withdrawn and a rubber band is tied around the root of the penis.

An incision is made in the median line of the abdomen, beginning three inches above the pubes and extending down over it, which divides the skin and subcutaneous fat. There is no linea alba in this region and the incision is carried directly through the muscular bundles, and the transversalis fascia is divided. The edges of the wound are held apart by large angular retractors and the bladder appears lying at the bottom of the wound. It is recognized by its shape and by the prevesical fat, which is adherent to it. If any doubt exists, it may be punctured with an exploring hypodermic syringe.

In old men the peritoneal fold in front of the bladder is sometimes unusually long, and extends down low into the space of Retzius. In such a case it should be peeled up from the bladder and held out of the way. If the peritoneum is accidentally wounded, it should be at once sewed up with fine catgut.

After the bladder is exposed, it should be steadied with a sharp hook, thrust through its wall at the upper angle of the wound, and two long silk retraction sutures are passed through the bladder-walls, at the sides of the wound.

These are held by an assistant and the bladder is opened between them by means of a stab-like thrust, with a long, sharp bistoury. As the water in the bladder is flowing out, the incision may be enlarged to the desired extent by means of a straight, blunt-pointed bistoury.

The cavity of the bladder is then searched with the finger, and the stone removed with a lithotomy-scoop or forceps. If it is desired to inspect the interior of the bladder, its walls may be distended by Watson's bladder speculum and the cavity illuminated by Pilcher's electric lamp or a head-mirror and reflected light.

The advisability of sewing the wound in the bladder or of leaving it open is still under discussion. All authorities, however, agree that in the presence of severe suppurative cystitis and foul purulent urine, the bladder should not be sewed, but left open for drainage. With a moderately-healthy bladder in young persons, opinions differ, and the following plans are adopted:—

(*a*) Kocher sutures the wound in the bladder with a double row of sutures, the first row including the mucous membrane, and the second row, which may be a continuous suture, includes the muscular and serous coats of the bladder. The space of Retzius is packed with gauze, and the wound in the abdomen left open for several days. If the stitches in the bladder hold, the abdominal wound may be closed by secondary suture. Drainage of the bladder is provided for by a permanent catheter introduced either through the urethra or preferably through a small perineal incision.

(*b*) In addition to suturing the wound in the bladder the abdominal incision is also closed by sutures, excepting the lower angle, through which a wisp of gauze is inserted for drainage.

(*c*) The wounds in the bladder and abdominal wall are not sutured, but are left open and allowed to heal by granulation.

By this latter method the convalescence is prolonged and the patient is subjected to a great deal of inconvenience from the urine flowing out over the wound and wetting the bed continually. To avoid this objection, the following plans for drainage have been suggested:—

(*a*) Guyon's double tubes. Two large rubber drainage-tubes are introduced through the abdominal wound into the base of the bladder, and gauze packed around them.

(*b*) In addition to the suprapubic tubes, permanent catheterization through a *boutonnière* is carried out.

(*c*) The Dawbarn bladder-drain consists in a reservoir of water hung upon the wall and from which the water flows out through a rubber tube. This rubber tube is connected to a single tube introduced into the bladder by a T-shaped glass tube. As the water flows out of the reservoir a suction is created which keeps the bladder empty.

(*d*) The Bloodgood bladder-drain which is a rubber bag attached to a hard-rubber tube entering the bladder. The urine flows out through it and is collected and retained in the rubber bag.

The length of time required for the healing of the wound is from two to three weeks when the bladder is sutured, and from three to six weeks when the wound is left to heal by granulation.

The after-treatment may be attended with difficulties, and there is always danger of urinary infiltration of the walls of the wound. In order to avoid this it has been recommended, and particularly so in the presence of a foul cystitis, to open the abdomen first, and to make the incision into the bladder several days later.

In the time elapsing between the two operations granulations have had time to form and septic absorption is prevented.

The *mortality statistics* of suprapubic lithotomy collected by Cabot show the following results:—

AGE.	CASES.	DEATHS.	PERCENTAGE.
Adults, 14 to 50 years..	100	12	12
Old men	53	17	32

OPERATIONS FOR CALCULUS IN CHILDREN.

Perineal Lithotomy.—The median operation is impracticable in children, on account of the difficulty in withdrawing a stone through the small posterior urethra. For the same reason Harrison's lithotrite cannot be used. The lateral operation, however, can be readily performed with much greater safety than in adults, for, as the prostate and urethra grow larger, they become more vascular, and the danger of hæmorrhage increases.

The lateral operation has a drawback in the danger of wounding the ejaculatory seminal duct and producing sterility on that side, in after-life. The mortality is about 3 per cent., and lateral lithotomy is still generally considered to be the operation of choice in the case of small stones in children.

Litholapaxy in children is attended with some difficulties, on account of the small size of the urethra interfering with the introduction of the lithotrite and the relative hardness of the stones, as met with. In spite of this it has been performed a great many times, and the death-rate is low: only about 3 per cent. As far as the death-rate is concerned, there is but little choice between lateral lithotomy and litholapaxy.

Suprapubic cystotomy in children is more dangerous, according to the collected statistics, than either of the other operations, the mortality being about 10 per cent., although stones one and one-quarter inches in diameter or over are considered too large for lateral lithotomy and must be removed through a suprapubic incision.

The size of a stone is readily estimated in children by the bimanual examination with one finger in the rectum and the other hand over the bladder.

DISEASES OF THE PROSTATE.

CHAPTER XIII.

SENILE HYPERTROPHY OF THE PROSTATE.

THE prostate is placed like a sphincter around the first inch of the urethra. It consists of two lateral lobes and a median central portion connecting them, which is sometimes spoken of as the third, or median, lobe. In its histological structure it resembles the uterus in the female, and is composed of muscular fibres, glandular elements, and a connective-tissue stroma uniting them.

While the gland may be enlarged as a result of gonorrhœa or sexual abuses in young men, *true hypertrophy* of the prostate never occurs until the decline of life, when other degenerative changes incident to advancing years begin. It is almost never observed until the patient is *past his fiftieth year.*

Sir Henry Thompson states that hypertrophy of the prostate exists in 34 per cent. of men at and above 60 years of age, and that it produces manifest symptoms in about 15 or 16 per cent. of the cases, when it is enlarged.

The *cause* of hypertrophy of the prostate is entirely unknown.

PATHOLOGY.

The pathological change consists in a general enlargement of the entire organ, or the increase in size may be confined to one or both lateral lobes or to the median lobe. The character of the enlargement of the gland and its size and consistency depend upon which of the normal tissues of the prostate have been chiefly affected by the process of hypertrophy.

The first change which occurs is a growth of the gland-tubules with their associated muscle, so as to form a new gland-substance closely resembling the normal prostatic substance. This constitutes the first or **glandular stage of hypertrophy.**

In this stage small tumors often form in the substance of the prostate, causing an enlargement, which is irregular and which may impinge upon the urethra and cause it to become distorted.

After a varying length of time degenerative changes set in, which ultimately convert the new tissue into a mass of more or less dense fibrous connective tissue, containing the atrophied remains of the glandular and muscular elements. This constitutes the second or **fibrous stage.**

After the adenomatous structures have been obliterated by the degenerative changes, the enlargement of the prostate becomes even and symmetrical, and instead of being soft and elastic, as in the glandular stage, it is *very hard and dense.*

The hypertrophy may consist in an overgrowth of both **glandular and stromal tissues in equal proportions,** causing a symmetrical enlargement of the prostate, which is not excessive and seldom causes any symptoms.

The **size** to which the prostate may grow depends upon the nature of the tissue involved. The prostate may be only slightly increased in size or it may become as large as a hen's egg or an orange, and in very exceptional instances may reach the size of a cocoa-nut, and fill up the entire pelvis.

Form of Obstruction.—In certain cases the lateral lobes may be enlarged, but in such a way as not to interfere with the urinary outlet, and it is possible to empty the bladder entirely. As a rule, however, **the posterior median portion, or third lobe,** becomes enlarged, and assumes the shape of a bar or dam across the mouth of the bladder, behind which the urine accumulates and cannot flow out, or the outgrowth may be more circumscribed in form and act as a ball-valve, which shuts down over the vesical orifice.

Alexander has recently suggested that the enlarged prostate interferes with the rhythmical contraction of the detrusor muscle, in the region of the trigone, and the bladder, on this account, is incapable of emptying itself of the last few ounces of urine, which are normally expelled by the action of this muscle. This view will serve to account for the cases in which there is no appreciable obstruction in the shape of a projecting outgrowth from the prostate, but where residual urine accumulates.

In many instances the enlargement of the prostate does not produce any symptoms, and it is only of consequence when it acts as an obstruction placed at the outlet of the bladder, thus preventing it from completely evacuating its contained urine.

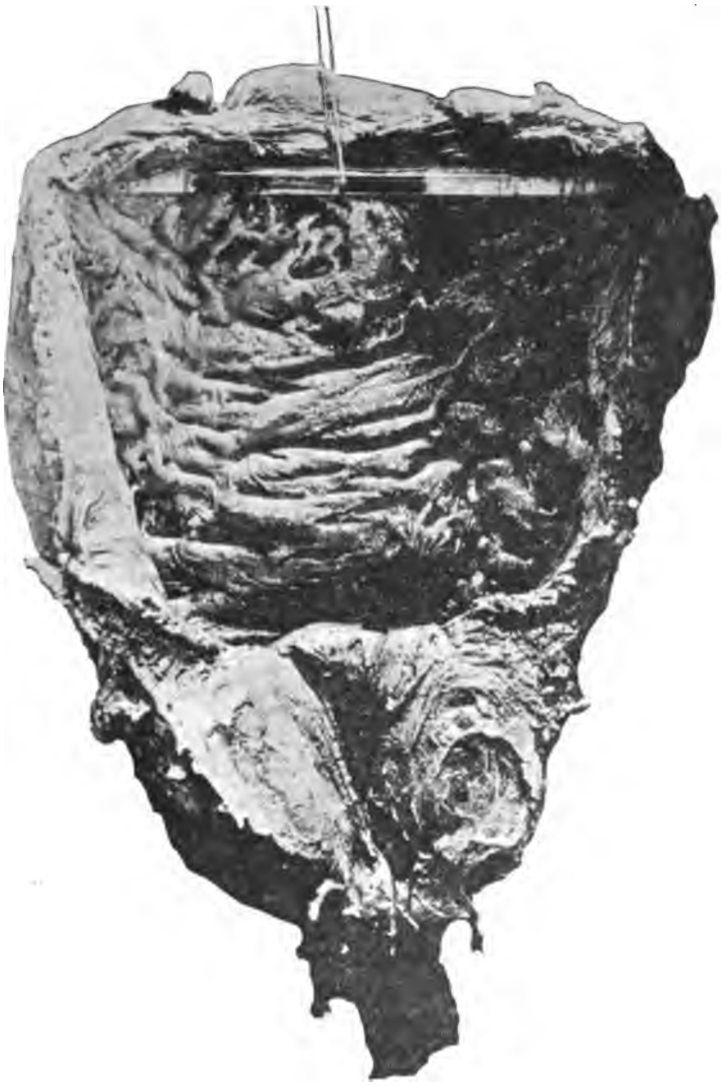

Fig. 66.—Prostatic Hypertrophy. Median Enlargement, in the form of a Bar. Suitable for Bottini's Operation. A large Bladder. (By Courtesy of Dr. F. S. Watson.)

Fig. [illegible] Enlargement of Lateral Lobes and [illegible] and [illegible]. By Courtesy of Dr. [illegible]

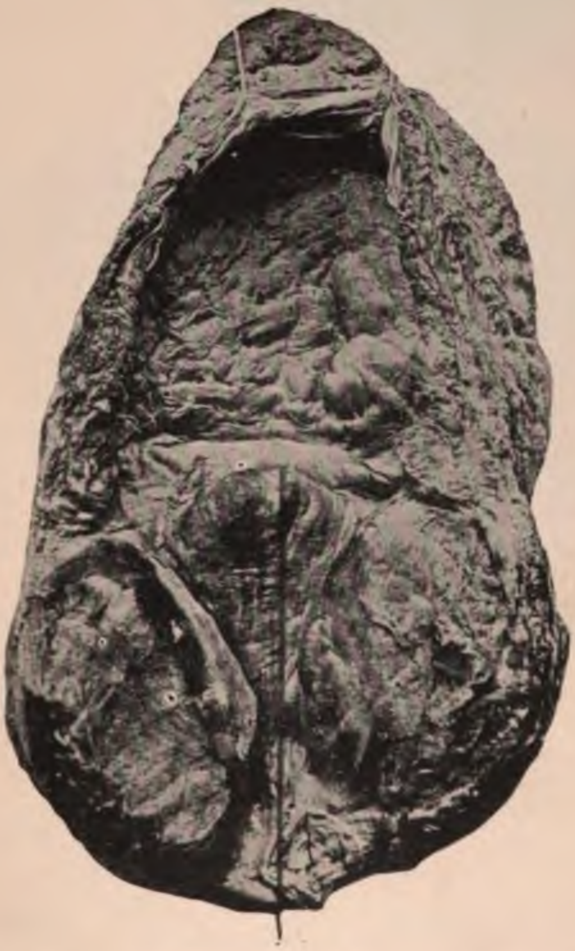

Fig. 67.—Prostatic Hypertrophy. Enlargement of Lateral Lobes and Median Portion. Bladder Contracted and Non-distensible. (By Courtesy of Dr. F. S. Watson.)

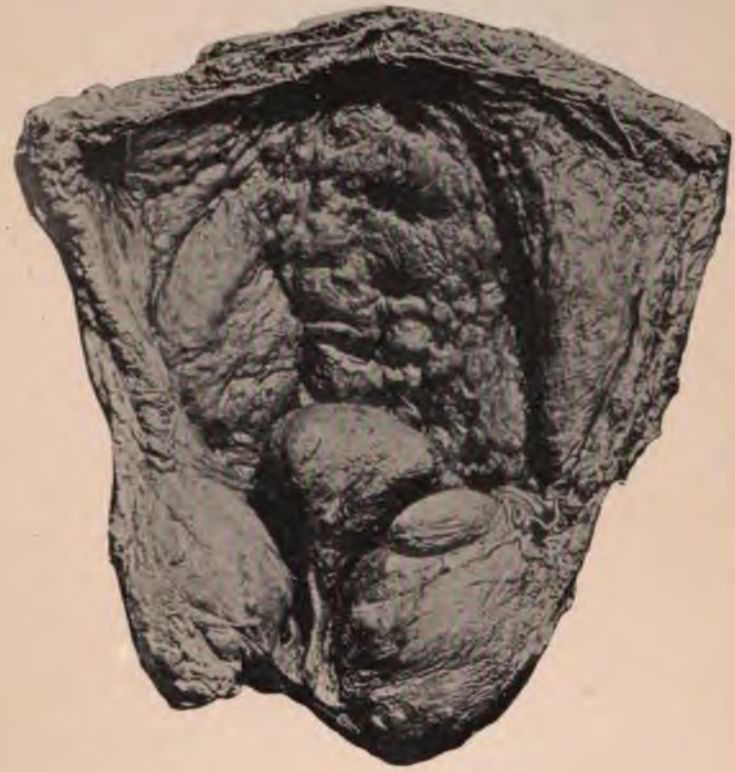

Fig. 68.—Prostatic Hypertrophy. Enlargement of Lateral and Median Lobes. Deep Post-prostatic Pouch. (By Courtesy of Dr. F. S. Watson.)

The various symptoms and diseased conditions which occur in consequence of the prostatic hypertrophy are all due to two conditions:—

(*a*) The obstruction caused by the enlargement of the prostate at the vesical outlet interferes with the urinary outflow, and the bladder cannot be completely emptied by the muscular efforts of the patient. Residual urine accumulates, pathological changes occur in the bladder-wall, and secondarily the ureters and kidneys become affected.

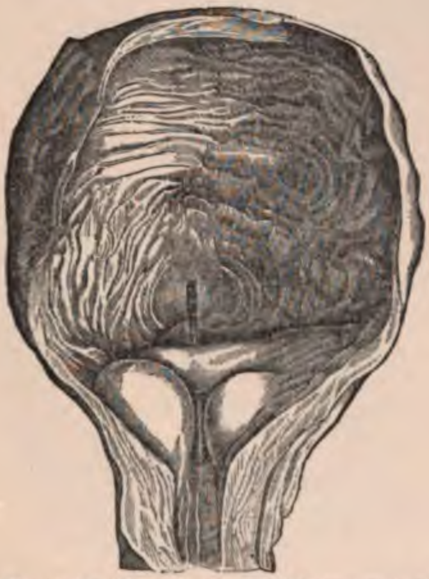

Fig. 69.—Prostatic Hypertrophy. Enlargement of the Lateral Lobes, with Increase in Size of the Median Portion, Forming a Bar, Through Which a False Passage has been Made.

(*b*) The return-flow of venous blood from the bladder-wall is prevented by the pressure exerted upon the veins by the enlarged prostate, and a congestion of the bladder-walls occurs as a result.

Changes in the Urethra.—In consequence of the enlargement of the prostate, notable alterations occur in the prostatic urethra:—

(*a*) It becomes elongated.

(*b*) The normal curve is changed.

(*c*) The calibre of the urethra, instead of being round, is flattened from side to side by the pressure of the lateral lobes, so that it becomes a vertical slit.

As a result of these changes catheters of ordinary shape are often inapplicable to cases of prostatic hypertrophy, and special catheters have to be employed.

SYMPTOMS.

One of the first symptoms of enlarged prostate which a patient observes is:—

I. Difficulty in starting the flow of urine.

In addition to this is noted:—

II. Deficiency in the force of the stream.

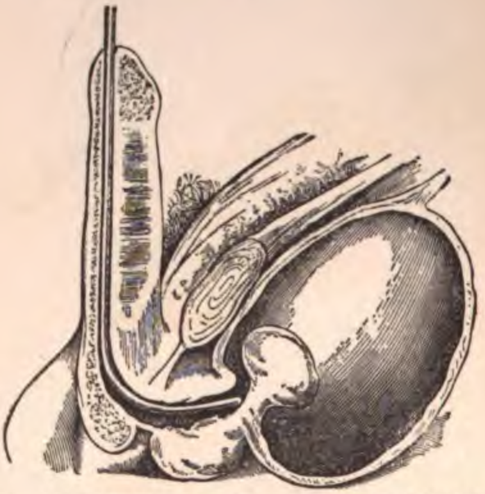

Fig. 70.—Prostatic Hypertrophy. Pedunculated Middle Lobe Obstructing Passage of a Catheter.

Both of these symptoms are occasioned, in part, by the feeble and atonic condition of the muscular fibres of the bladder, and partly on account of the prostatic obstruction.

III. Frequent calls to urinate especially at night.

This symptom is explained by the fact that the enlarged prostate presses on the plexus of veins lying around it, and so obstructs the flow of venous blood. As the blood from the bladder is returned through this plexus, any interference with its circulation causes a passive congestion of the bladder-walls. Through the day the muscular activity improves the circulation, but at night the muscles are in repose, and a passive hyperæmia occurs.

The increased frequency of urination at night often helps to distinguish a case of enlarged prostate from one of vesical calculus. In the case of a stone the desire to urinate is more frequent during the day, when the stone is rolling about in the bladder, but at night the patient is quiet in bed, and the stone does not cause much irritation.

One of the most important conditions from the stand-point of treatment and prognosis, which enlarged prostate gives rise to, is **residual urine.** Residual urine may be defined as the urine which remains in the bladder after the patient has voluntarily tried to evacuate it completely, and always occurs as a result of an obstruction.

Residual urine exists in the majority of cases of prostatic hypertrophy, and in the early stages and in cases of slight obstruction may only amount to an ounce or two. The tendency is for it to increase in quantity as the bladder-walls become atonic and the prostatic enlargement becomes more developed; so that in exceptional cases it may reach a quart in quantity.

After residual urine has existed for a varying length of time **cystitis** is generally excited by the entrance into the bladder of micro-organisms, coming from the urethra or rectum or introduced artificially upon a dirty catheter.

The causation of cystitis is favored by the stagnant residual urine and also by the catarrhal mucus, which is formed in the congested mucous membrane lining the bladder as a result of its condition of chronic passive hyperæmia.

The urea of the urine is decomposed by bacterial action, assisted by the presence of the catarrhal mucus, and carbonate of ammonia is set free. The urine becomes alkaline in reaction and ammoniacal in odor, is strongly irritating, and adds still further to the existing inflammation of the bladder-wall.

When cystitis is well established, the frequency of urination is increased, and the patient *urinates as frequently by day as at night.*

The mucous membrane of the bladder surrounding the urethral orifice becomes turgid and congested, and serves to occlude still more the outlet from the bladder, and the residual urine increases. The various changes dependent upon cystitis and obstruction lead to **changes in the wall of the bladder.** In order to furnish sufficient propelling force to overcome the obstruction formed by the prostatic overgrowth, the muscular fibres of the bladder-wall undergo **hypertrophy.** The bundles of muscular fibres grow larger and project into the bladder, and diminish its capacity.

The muscular efforts of the bladder force the urine between the bundles of muscle, and in time **saccular dilatations** form, which may be as large as the bladder itself. As these sacs are only covered outside with peritoneum and the serous wall of the bladder and have no muscular fibres, they cannot empty themselves. In consequence, the urine stagnates and decomposes, and it frequently happens that a calculus forms in them.

In course of time as the case progresses the hypertrophy gives place to **atrophy and distension.** The distension of the thinned bladder-wall may be very great; so much so, that it may contain a quart of residual urine and reach as high as the umbilicus.

The distension occurs so gradually that the patient is unaware of his condition, and notices only a slight feeling of weight in the abdomen, and that his habitually frequent urination is slightly increased. As the residual urine increases, the bladder grows more distended and the intervals between the acts of urination become still shorter. After the bladder is stretched and distended to its utmost capacity a new symptom occurs: that of **incontinence of urine, or constant dribbling.**

The bladder is so full that it can hold no more, and the overtaxed sphincter yields, allowing the escape of a small quantity of urine every few minutes.

The conditions of decomposing residual urine and cystitis just described provide suitable conditions for the formation of **phosphatic calculi.** As Keyes expresses it, "Stone is the logical sequence of obstruction to urinary outflow aided by vesical catarrh."

The stagnant decomposing urine deposits salts, which become glued together by muco-pus into a solid concretion, or are deposited upon a nucleus, which may be a bit of necrotic tissue sloughed off from the bladder-wall.

A single stone or several may exist without causing any symptoms, and they may lie unsuspected for months in the pocket behind an enlarged middle lobe. Their surfaces are smooth, and they are prevented from rolling about in the bladder, and the weakened muscular fibres of the bladder cannot drive them forcibly out of the post-prostatic pouch against the vesical orifice during the act of urination.

It sometimes happens that after hypertrophy begins the bladder-wall, instead of growing weakened and atonic and ultimately becoming dilated, undergoes **hypertrophy with contraction.** In this condition the overgrowth of the prostate does not form an obstruction to the outflow of urine, and residual urine does not accumulate, and the bladder, instead of being distended and enlarged, undergoes a *diminution in the size of its cavity,* so that it may only contain six or eight ounces of urine when fully distended.

In addition to the contraction of its size there is also a permanent congestion of the vesical neck from pressure on the veins by the enlarged prostate. This venous engorgement occasions an extreme irritability of the bladder, with an almost constant desire to urinate.

Of the two conditions spoken of, the patient with an atonied, relaxed bladder which does not cause him trouble, even though it is incapable of emptying itself except by catheter, suffers far less inconvenience than the man who has an hypertrophied irritable bladder, and is tormented continually with an intolerable desire to urinate.

Changes in Kidneys and Ureters.—As the obstruction offered by the prostate increases, a greater amount of muscular effort is required to empty the bladder, and, as a result of the pressure, the urine is forced back into the ureters, causing them to become distended, and sac-like dilatations form at various points.

The backward pressure and damming back of the urine is continued, and saccular dilatations of the pelves of the kidneys occur, giving rise to **hydronephrosis.**

The salts of the stagnant decomposing urine are deposited, and calculi are apt to form in the various dilatations in the kidney.

The process of dilatation becomes further complicated by germ-infection, which usually ascends up the ureters, and as a result causes pyelitis or abscess of the kidney.

Retention of urine occurs in nearly every case of enlarged prostate, and presents itself in two forms:—

(*a*) *Acute Retention.*—This occurs suddenly in an individual who up to that time had been able to pass water with a fair degree of freedom. It is frequently brought on by chilling or wetting the surface of the body and taking cold. The sudden congestion of the mucous membrane around the vesical orifice causes it to swell up and occlude the opening entirely, in the same way that a cold in the head will close up the nasal passages.

On the other hand, the retention may be occasioned by a spasmodic contraction of the cut-off muscle (spasmodic stricture), which occurs as a reflex from constipation and scybala in the rectum, acid condition of the urine from overindulgence in wine or malt liquors.

(*b*) *Chronic retention*, as already described, is caused by the obstruction at the vesical outlet from the enlarged prostate and partly induced by the atonic condition of the muscular walls of the bladder.

DIAGNOSIS.

In the case of a man over fifty years of age, complaining of difficulties of urination, enlarged prostate should always be suspected.

It is desirable to conduct the examination systematically, and to that end

I. A rectal examination should be made, to feel the prostate and judge of its size and consistency and to determine, if possible, whether the enlargement is fibrous or glandular in character.

Of course, only the posterior portion of the gland can be felt through the rectum, and it is impossible to determine the shape of the obstructing overgrowth in this way, but its density and the extent of the enlargement of the entire gland can be determined by the rectal touch.

II. The quantity of residual urine should be collected and measured after the following method: The patient is requested to pass water, and endeavors to empty the bladder completely. A catheter is then introduced into the bladder, and all the urine which remains behind and which the patient was unable to void spontaneously is known under the term "residual urine." The residual urine should be measured and set aside for microscopic examination.

The *quantity* of residual urine indicates the extent to which the prostatic enlargement interferes with the complete emptying of the bladder; but in order to determine the *shape* of the outgrowth which projects up into the bladder and blocks its outlet, we must have recourse to the cystoscope.

At the time of collecting the residual urine we can also determine the *length of the urethra* by measuring the distance from the eye of the catheter to the point upon its shaft to which it is necessary to introduce it before the urine begins to flow. This measurement often fails to demonstrate an existing enlargement, as a decided amount of obstruction may be present which causes but very little elongation of the urethra.

III. By means of a **cystoscopic examination** it is possible to see the enlargement of the middle lobe projecting upward, and to some extent to see a lateral lobe if it impinges upon the vesical outlet. As the cystoscope is introduced through the urethra it will also serve to exclude the presence of a *tight stricture*, and by its use in the bladder we can prove the presence or absence of *vesical calculus*, which is so apt to be present in cases of enlarged prostate with residual urine.

There are certain **precautions to observe** in every examination of prostatic cases: The patients are old men whose vitality is low and who are more or less feeble. Their urinary passages are in an irritable condition, and they are very liable to *urinary fever*, and any prolonged or rough examination is apt to be followed by chills, fever, and constitutional disturbances. For these reasons the instruments should be aseptic, and when practicable it is desirable to cleanse the urethra and bladder by irrigation before instrumentation.

The instruments should be used with extreme gentleness to avoid any traumatism, which would allow the entrance of micro-organisms into the circulation, and the first examination should not be too prolonged.

It is desirable that the patient should be examined for the first time in his own home, so that he can go to bed at once after the examination, and thus avoid the necessity of going out-of-doors, running the risk of chilling the body.

A distended bladder should never be emptied at the first sitting. Cases are on record where sudden death has occurred when a full bladder has been emptied by the catheter with the patient in a standing position.

Although such an event is, of course, rare, drawing off the entire contents of the bladder allows the enlarged blood-vessels which have been accustomed to the support of a certain amount of fluid to collapse, a transudation of blood follows; so much so that a great deal of hæmorrhage may occur, and the existing cystitis is always made worse.

If the bladder is considerably distended, it is always better to leave one-half or one-fourth of its contents in it, or to inject six or eight ounces of warm salt or borax solution and leave it in.

GENERAL TREATMENT.

In all cases of prostatic hypertrophy **hygienic measures** are very important in preventing attacks of retention of urine. The patient should wear flannel underclothing in winter, and, as the circulatior blood is poor in the feet and they are the parts most easily chilled, woolen stockings should be worn.

He should avoid any overindulgence in alcohol or malt liquors, although a glass or two of claret or a little whisky may be permitted.

The bowels ought to receive due attention, and constipation should be guarded against. Any overdistension of the bladder with retained urine has the effect of still further weakening the atonic muscular walls, and on this account the patient should be instructed to pass his water at regular intervals, two to four hours apart.

In the early stages of prostatic hypertrophy, when the enlargement is only moderate in size and not very dense, and when the quantity of residual urine is small, the chief source of annoyance to the patient is from the irritability of the bladder, which causes a frequent desire to urinate.

Such cases are often benefited by the passage of a **large-sized steel sound,** which relieves the irritability of the bladder and overcomes the muscular spasm of the urethra. The action of the sound is to press out and empty the engorged venous plexus around the prostate, and while it does not prevent the increase in size of the gland, it seems at least to retard its growth. The sound should be used once in every five days, and allowed to remain lying in the urethra from ten to fifteen minutes at a time.

The presence of **residual urine** offers an important indication for treatment.

If the residual urine is only one or two ounces in quantity and clear in color, it is only necessary to pass the catheter once in four to eight weeks, in order to observe the progress of the case and ascertain that the obstruction is not becoming greater or the atony of the bladder-wall increasing.

In time, however, the residual urine increases in amount, and, when it reaches three or four ounces in quantity, the catheter should be employed once a day to remove it from the bladder, a convenient working rule (if the urine is sterile) being to use the catheter once daily, preferably at bed-time, for three ounces, twice daily for six ounces, and then once more for every additional two ounces. With sterile urine it is rarely necessary to catheterize oftener than once in four hours.

Unfortunately, however, the bladder rarely escapes infection for any length of time after beginning catheterization, and then a new element is introduced into the case: that of **cystitis.** Inflammation of the bladder is generally ushered in by some rise in temperature, which may run for a few days and subside or may continue for some length of time, as a result of absorption into the blood of septic material.

The frequency of the desire to urinate is notably increased, and the urine contains pus and in the early stages blood may be present.

The fermentative changes in the urine rapidly cause its decomposition, and it becomes strongly alkaline in reaction and ammoniacal in odor.

After cystitis has lasted for a short time the contractility of the muscular fibres of the bladder-walls is still more impaired, and the residual urine increases in quantity, so that the catheter has to be used more frequently, in order to prevent the accumulation of urine, which is stagnant and soon decomposes.

The indications for the treatment of this condition may be summed up as follows:—

(*a*) Drain the bladder of residual urine.

(*b*) Keep it as clean and aseptic as possible, and check decomposition of the urine by means of bladder-washing and the administration of urinary antiseptics by the mouth.

For the treatment of the cystitis the reader is referred to the chapter on the treatment of "Chronic Cystitis."

The ordinary routine treatment of a case of prostatic hypertrophy, consisting in **bladder-washing and daily catheterization,** can be readily carried out by the patient himself, if he is moderately intelligent, after he has been instructed by his attending physician.

The best form of catheter for him to use is the soft-rubber instrument, and, indeed, every patient with enlarged prostate should be familiar with the method of passing the catheter and should keep one at hand, as he is always liable to an attack of retention of urine from some slight cause, and unless prompt relief can be obtained the bladder-wall may suffer irreparable damage from the distension and stretching caused by the accumulation of urine.

An important part of the instruction of the patient consists in teaching him the proper method for the **care of the catheter.** This is a very material point in the management of the case, and, if cystitis is not already established, the frequent use of the catheter generally induces it, unless the greatest care to avoid infection is taken by means of scrupulous cleanliness.

It is not difficult to cleanse the outside of the catheter, but the interior is its most dangerous part, on account of the difficulty of disinfecting it.

After using the catheter a stream of hot water should be allowed to run through it from a faucet or forced through with a syringe, in addition to scrubbing off the outside with soap and water. But even this is not sufficient to remove all the accumulations of pus and urine, etc.

Boiling the catheter in plain water is a perfect means of disinfecting the soft-rubber instruments, and, by having a number of them, they can all be boiled at once and laid away in clean towels and a fresh one taken for each catheterization.

The formalin sterilizing cabinet also affords a reliable means of disinfecting, both the soft-rubber and the gum-elastic instruments, after first scrubbing and allowing water to flow through them, and the plan of sterilizing a number of instruments at the same time may be adopted.

These methods, however, cannot always be applied to every case, as in the instance of travelers, who cannot carry the necessary sterilizing outfit. In such cases the catheter may be kept sterile by immersing it in a bottle of carbolic-acid solution from 2 to 5 per cent., after washing, and allowing it to remain there.[1]

In every case the catheter should be frequently inspected, and discarded at once when it becomes dry and cracked.

At the time the patient is instructed as to taking care of his catheter he should also be taught to wash the glans penis with a cotton sponge and soap and water every time before the catheter is introduced, in order to avoid carrying micro-organisms into the urethra from the head of the penis.

But in spite of all precautions it is most exceptional for the urine to remain clear, and, as a rule, a slight degree of cystitis is continually present. On this account and to lessen the tendency to the formation of calculus, it is very desirable that the patient should use **irrigation of the bladder** once or twice each day.

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[1] The following solution is now being used in Berlin for sterilizing gum-elastic catheters:—

℞ Glycerin,
Water .... of each ℥viij.
Corrosive sublimate .... gr. viij.

After six hours' immersion laboratory experiments show the catheter to be sterile, and prolonged immersion in the fluid does not roughen or crack the surfaces.

This can be very readily done, at the time he uses the catheter, by means of a rubber douche-bag or fountain-syringe raised up three feet high and attached by its tube to the end of the catheter. The mild solutions, either boric acid, salt solution, or permanganate of potash are suitable for this purpose.

Commencement of Catheter-life.—In cases of prostatic hypertrophy where there is little or no cystitis and the quantity of residual urine is only from four to six ounces, if due precautions are taken to guard against cystitis, the patient very soon becomes accustomed to the use of the catheter. But, in those instances where the residual urine amounts to ten ounces or more, a considerable amount of *constitutional disturbance* usually follows the first catheterization. Urinary fever generally occurs, and, if the kidneys were previously diseased and the patient is very old and feeble, it is by no means rare for the case to terminate by death.

It is desirable, then, before beginning catheterization, in the presence of *large quantities* of *residual urine*, to warn the patient that there is some risk attached to the procedure, and to insist that he shall remain quietly at his home and for the most part in bed for a fortnight. During that time the urine should be drawn by the catheter three or four times a day and from four to six ounces of boric-acid solution thrown into the bladder each time that the urine is withdrawn, so that the bladder will not be left entirely empty.

Urinary antiseptics should be given by the mouth, but it is better to avoid washing out the bladder for the first week or so, until a certain degree of tolerance is established. Under these precautions the advanced cases of prostatic hypertrophy with an excess of residual urine are introduced into catheter-life with a minimum degree of risk. But even in spite of all care patients who are old and feeble, and are suffering from chronic Bright's disease or pyelitis, sometimes develop a chronic form of urinary fever, induced by the beginning of catheter-life, which terminates fatally.

In these instances death would have resulted from the kidney disease, in any case, after a short time, and, had the use of the catheter been commenced at an earlier period in the disease, the secondary involvement of the kidneys would have been avoided.

Retention of Urine.—Most old men with enlarged prostates suffer at some time in their lives with an attack of acute retention of urine, from spasm of the cut-off muscle and swelling of the mucous membrane at the vesical outlet. Such a condition calls for *prompt* *catheterization.* The use of prolonged hot baths and a full dose of opium, which so often relieves a spasmodic stricture in a young man, is not to be recommended in retention of urine from an enlarged prostate. The overdistension of the bladder must be relieved at once, as the stretching of its muscular fibres induces a condition of atony.

The form of *catheter* to be selected depends upon the shape which the overgrown prostate has assumed. It is often found impossible to introduce a flexible soft-rubber catheter, and it is necessary to try various shapes, until one is found which will override the obstruction offered by an enlarged middle lobe or an adenomatous tumor which deflects the urethra to one side.

The form of catheter which is most frequently serviceable is the *Mercier catheter*, with the end turned up (coudé). The angled end usually slips up past an enlarged middle lobe and enters the bladder. The catheter bicoudé acts in a similar manner and is useful when the overgrowth of the middle lobe is excessive.

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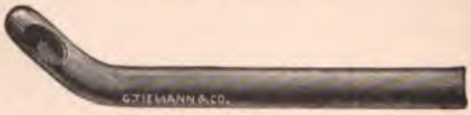

Fig. 71.—Mercier Catheter Coudé.

The *silver prostatic catheter*, with a long beak and an exaggerated curve, is especially designed to fit the elongated sweep of the urethra distorted by the prostatic overgrowth, and is frequently successful in reaching the bladder. When it fails to enter the bladder the following manipulation is often successful: The surgeon has provided himself beforehand with a common English catheter with a stylet, which has been previously prepared by giving it an exaggerated curve, and it is then laid away until needed. When it is wanted, the stylet is withdrawn and the catheter is introduced into the urethra. The warmth of the body causes the curve to increase, and the point of the instrument overrides the obstruction. The catheter may also be introduced with the stylet in it down to the prostatic urethra. When it reaches this point the stylet is withdrawn and the point of the instrument curves around the enlarged prostate.

In the manipulations with the silver and English catheters due care should be used not to make a *false passage* in the swollen tissues around the prostate. The attempts to reach the bladder with a filiform guide and a tunneled sound threaded over it are of very little use except in cases of stricture.

A bladder which is full and distended, if it has been so for more than a few hours, should *never be completely emptied at one sitting,* but six or eight ounces of urine or boric-acid solution should be left in it, to support the blood-vessels and give the muscles something to contract on.

If all attempts to enter the bladder are unavailing, in order to relieve the retention it is necessary to have recourse to **suprapubic aspiration of the bladder.**

The needle attached to the aspirator is thrust directly downward, a finger's breadth above the pubes, and penetrates the bladder without wounding the peritoneum, as when the bladder is distended the fold of peritoneum covering it is raised up two and one-half inches above the pubes.

Aspiration affords prompt relief; but, while the bladder has been emptied for the space of a week by means of repeated aspirations, it cannot be done with safety more than a few times.

Suppuration often results after three or four tappings, or the bladder-wall becomes soft and leaks; so that aspiration can only be depended on as a temporary expedient, for a day or two.

In certain cases of enlarged prostate, which are suffering from chronic retention, it is desirable to keep the bladder empty and at the same time avoid the frequent introduction of a catheter; to attain this end **continuous catheterization** is accomplished by introducing a soft-rubber catheter into the bladder and tying it, so that it cannot be forced out.

The indications for the use of continuous catheterization are summarized by J. W. White as follows:—

(*a*) When great difficulty is experienced in introducing the catheter.

(*b*) When much bleeding follows the introduction of the catheter, as is generally the case when unsuccessful attempts at catheterization have been made before.

(*c*) When much cystitis with purulent or ammoniacal urine exists and the frequent passage of a catheter is impracticable on account of the pain and hæmorrhage which it produces.

By means of continuous catheterization the bladder is drained and readily washed out, and a general improvement in the symptoms takes place.

CHAPTER XIV.

OPERATIVE TREATMENT OF HYPERTROPHIED PROSTATE.

THE removal of the obstruction offered by an enlarged prostate, by means of a surgical operation, is not to be thought of in patients who have but a small quantity of residual urine and little or no cystitis, and when catheterization is easy and not accompanied by pain or bleeding. In many instances the patient can be made entirely comfortable throughout his life by regular catheterization.

In some cases, however, when the catheter has been used for a long time, the prostatic hypertrophy increases in size, the contractile power of the bladder lessens, the cystitis grows worse, and the presence of a small quantity of urine in the bladder causes extreme tenesmus until it is removed. As a result of the frequent demands for urination, the catheter has to be passed so often that the urethra becomes irritable and bleeds freely, and the cystitis grows progressively worse. In the expressive words of J. W. White the condition of the patient is that of "approaching break-down in catheter-life." These are all indications that catheterization will soon have to be discontinued and some other means of draining the bladder adopted.

Indeed, all of the surgical operations for prostatic hypertrophy are directed to the one end of *draining* the *bladder*, either through the removal of the obstructing portion of the prostate or by means of an artificial permanent fistula.

A list of the operations may be tabulated as follows:—

Radical Operations.—

- Bottini's Operation.
- Prostatotomy
  - Perineal.
  - Suprapubic.
- Prostatectomy
  - Suprapubic,
  - Perineal, or
  - Combination of both.
- Vasectomy.
- Castration, or Orchidectomy.

Palliative operations, in which no part of the prostate is removed, are only undertaken for the purpose of draining the bladder through a fistulous opening:—

(*a*) Perineal cystotomy and drainage through a catheter retained in the bladder.

(*b*) Suprapubic cystotomy.

(*c*) Puncture through the substance of the prostate with a trocar.

BOTTINI'S OPERATION.

Bottini's operation consists in burning channels through the enlarged prostate by means of a specially-devised instrument, heated with the electric current, and introduced into the bladder through the urethra. The instrument was devised by Bottini, of Pavia, Italy, and used by him for over twenty years.

Description of Instrument. — The instrument is shaped like a lithotrite, and is provided with a thin platino-iridium blade, which is concealed when the instrument is closed, and is moved backward or forward in a slot in the shaft by turning a wheel at the end of the instrument. This blade is heated to a dull cherry red by means of an electric current conducted to it from a storage battery, through a cord attached to the extreme end of the instrument. All parts of the instrument, except the blade, are prevented from becoming heated by a stream of cold water, which constantly circulates through it.

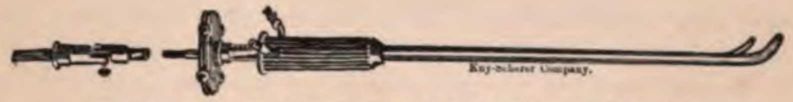

Fig. 72.—Bottini's Instrument, as Modified by Freudenberg.

Technique of Operation.—General anæsthesia is not required; a 4-per-cent. solution of cocaine is introduced into the posterior urethra, after first washing the bladder with boric acid and letting it run out again through the catheter. Bottini's instrument is introduced into the bladder and hooked up against the projection of the middle lobe. The cold-water stream is turned on, and when everything is in readiness the electric current is switched on, a pause of ten seconds is made for the blade to become hot, and then the wheel is slowly turned, causing the red-hot blade to slide out from its place of concealment and slowly burn its way through the tissues of the prostate. After the incision has been made deep enough the wheel is reversed, and the blade is slid back into its place of concealment, charring for a second time the tissues of the incision, and then the electric current is turned off.

An anterior cut is made in the same way and a lateral cut through the lobe which is apparently most enlarged.

The *length of the incisions* depends upon the size of the prostate, but, as a rule, three centimetres are sufficient for the posterior cut and two centimetres for the lateral cuts.

The *after-treatment* consists in keeping the patient in bed and passing a catheter if there is retention of urine.

Hæmorrhage is a rare accident, but can be controlled by the pressure of a large-sized catheter tied in the bladder.

It is not necessary to pass sounds, as the cuts show no tendency to close up.

The sloughs usually separate about the eighth to the fourteenth day, and some slight bleeding occurs; and if the operation has been successful in severing the obstruction the urine begins to flow freely.

The maximum of improvement is not attained, however, until after four weeks have passed, as by that time the bladder has recovered its tone to some degree, and the cicatrices in the prostate, formed by the healing of the incisions, have begun to contract and open up the passage.

Selection of Cases.—Bottini's operation appears to be *contra-indicated* in the cases of very large prostates the size of a small apple or larger, as the instrument can scarcely burn a furrow in them deep enough to overcome the obstruction.

It is particularly adapted to the small, hard, fibrous prostates where there is a decided bar at the neck of the bladder.

The advantages of the operation are that:—

(*a*) No anæsthetic is required, and it is not accompanied with great pain.

(*b*) It is comparatively free from danger to life.

(*c*) It is applicable to the hard, fibrous prostates which cannot be successfully removed by prostatectomy and which do not atrophy after castration.

Results, as shown by Wossidlo's statistics:—

CASES.	CURED.	IMPROVED.	NO RESULT.	DEATHS.
110	65	16	20	9
	59 per cent.	13.6 per cent.	18.2 per cent.	8.2 per cent.

PROSTATOTOMY.

By the term of prostatotomy is understood the simple division of a middle lobe, or cutting off a prominence which juts out like a nipple and projects into the bladder, or the cutting of a V-shaped piece out of the prostate, in order to get a low-level channel from the bladder.

Prostatotomy may be performed by means of an opening into the bladder made *above the pubes,* but the *perineal* route is the one usually selected.

If the prostate is not more than three inches thick, it is possible, by means of an opening in the perineal urethra, to reach a projecting middle lobe, which may be readily divided with a knife, or, if it has assumed a nipple-like form, can be snipped off with scissors or an écraseur.

It is rarely possible by means of a simple prostatotomy to remove enough of the overgrowth of prostatic tissue to relieve the symptoms of obstruction, and the chief advantage which follows is from the benefit which the patient derives from the prolonged drainage of the urethra through a catheter and the attendant improvement of the cystitis.

According to Watson, 50 per cent. of cases subjected to perineal prostatotomy had a restoration of the function of the bladder and 10 per cent. died.

PROSTATECTOMY.

In this operation the entire substance of the prostate is enucleated from its capsule and removed through an incision.

Perineal Prostatectomy.—As a result of the experience gained in prostatotomies, in which a projection from a median lobe was torn off or a V-shaped piece was cut out of it, the next step in the development of the operation was to *enucleate* the *entire gland* through a perineal incision.

In this operation, as it was done originally, the prostate was approached through a median perineal incision by which the urethra was opened into, as in external urethrotomy. . The wound thus made, however, was too limited in extent to afford ready access to the gland, and a transverse perineal incision two and one-half inches in length and curving around the rectum was adopted.

In one-third of the cases it was found, at the time of operation, that the distance from the junction of the membranous and prostatic urethra to the most distant point of the median enlargement within the bladder was more than three inches, and consequently the prostate was located out of reach of the finger, and enucleation was impracticable.

To obviate this difficulty Alexander and Nicoll practice making a suprapubic incision *into the bladder*, and, by means of two fingers introduced into the bladder, press the prostate down, so that it can be easily reached through a median incision in the perineum.

The advantage of opening the bladder above the pubes is not alone to press down the prostate so that it can be reached from below, but an opportunity is afforded to examine the cavity of the bladder thoroughly with the finger and to search for and remove a calculus, if present. If the stone should happen to be located in a saccular dilatation of the bladder, it would be impossible to remove it in any other way.

Technique of Alexander's Operation of Perineal Prostatectomy Combined with Suprapubic Cystotomy.—The bladder is first opened by means of a suprapubic cystotomy. The patient is then placed in the lithotomy position, and a grooved staff introduced through the urethra into the bladder. The membranous urethra is opened upon the staff by means of a median perineal incision. The forefinger of the surgeon's left hand is then passed through the suprapubic wound in the bladder, and presses the prostate downward into the perineum. The forefinger of the right hand is introduced through the perineal wound into the prostatic urethra, and its mucous membrane is torn through at one side. The finger is pushed through the opening thus made, and enucleates one of the lateral lobes of the prostate. The piece, after it is enucleated, can be seized with forceps and withdrawn through the perineal wound.

The finger is then reintroduced, and the lateral lobe of the other side and the middle lobe are enucleated and removed in the same way. The only part of the urethra which is torn lies in front of the ejaculatory ducts. The perineal wound is drained through a large catheter carried through it into the bladder, and hæmorrhage is controlled by a gauze packing around the catheter. A drainage-tube is introduced through the wound in the bladder, and the bladder-walls sutured around it. Both wounds are usually healed at the end of five weeks.

The *advantages* which Alexander claims for his method are as follow:—

"I. The entire obstructing portions of the prostate are thoroughly removed through a perineal opening without injury to the mucous membrane of the bladder or of the prostatic urethra above the opening of the seminal ducts.

"II. Hæmorrhage is rarely a serious complication.

"III. The most efficient and thorough drainage of the bladder is secured.

"IV. The time required by practiced hands to perform the operation is comparatively short.

"V. The best conditions are left for a return of complete voluntary urination."

"*The dangers of the operation* are:—

"I. Suppression of urine in those cases in which there is advanced renal disease.

"II. Hæmorrhage, which is rarely serious and can always be controlled by packing the perineal wound with gauze about the drainage-tube.

"III. Injury to the rectum. It is, however, only necessary to remember this danger to avoid it."

The *results* in Alexander's hands are as follow: Out of 31 cases operated upon, 3 deaths, 1 partial success, and 27 successful cases, in which the vesical function was restored and patients emptied their bladders completely.

Suprapubic Prostatectomy.—The removal of the prostate gland by means of a suprapubic cystotomy is considered by some surgeons to possess certain advantages over the perineal operation. The patient is saved any loss of blood from the perineal incision, and the operation can be very rapidly performed.

There is, however, great liability to lacerate the base of the bladder if the prostate is at all adherent, but the chief disadvantage comes from the urine soaking through the incision which is made in the base of the bladder for the purpose of enucleating the prostate, and causing suppuration of the surrounding tissues, and the hæmorrhage is often alarming.

The suprapubic operation can only be performed when the cavity of the bladder is fairly capacious, for when the bladder-walls are thickened and its cavity very much contracted, this operation is impracticable.

The operation of suprapubic prostatectomy as originally performed by Belfield and McGill has been simplified in certain points by Eugene Fuller.

Technique of Fuller's Operation.—The patient is laid flat upon his back. The Trendelenburg posture is not adapted, nor is Petersen's rectal bag used. The bladder is filled with ten ounces of boric-acid solution, and a rapid suprapubic cystotomy is made.

The location and extent of the prostatic obstruction is determined by examination with the left forefinger. By means of a pair of long-handled scissors, with serrated edges, slipped along the left forefinger as a guide, an incision is made through the mucous membrane of the bladder, which lies above the prostate.

The cut exposes the prostatic tissue, and extends from the margin of the internal vesical opening of the urethra about one and one-half inches in a backward direction. The serrated edges of the scissors prevent any free hæmorrhage from the incision.

Firm counter-pressure is made with the fist against the perineum, and the forefinger of the other hand is slipped through the incision in the bladder-wall, and by means of the finger the entire prostate is enucleated, *en masse* or piece by piece, depending upon the character of the growth.

After the prostate has been entirely enucleated the patient is put in the lithotomy position, an opening is made into the urethra through the perineum, and a large-sized rubber catheter is inserted, through it, into the bladder for purposes of drainage.

Finally, after hot irrigation, the wound in the abdominal wall is partially closed with silk-worm-gut sutures, one of which includes the bladder-wall at the upper angle of the vesical incision and another one passes through the bladder-wall at the lower angle of the wound. In this way the bladder is kept in close apposition with the abdominal wall, so that there may be no leakage into the space of Retzius. A double drainage-tube is inserted into the bladder.

The chief element of success in this operation is the *rapidity* with which it is performed, and it is also essential to use the *smallest quantity of ether* with which anæsthesia can be maintained, on account of the lowered vitality attendant upon the age of the patients.

The after-treatment consists in careful and thorough vesical irrigation through the drainage-tubes and the administration of large quantities of distilled water by the mouth, for its diuretic effect.

In order to guard against hypostatic pulmonary congestion from lying in bed, the patient should never be allowed to lie long in one position, but should be carefully turned from side to side, and the shoulders should be elevated occasionally.

Results of Suprapubic and Perineal Prostatectomy.—At the time that the operation of complete removal of the prostate first came into prominence the objection was raised by Guyon, Socin, and Thompson, on theoretical grounds, that, even though the obstructing prostate be removed, the contractile power of the bladder has been so much impaired that the patient will be incapable of spontaneous urination after the operation. The tabulated results of 150 prostatectomies, however, now demonstrate that in 75 per cent. of the cases restoration of the bladder function does take place, and that patients who were previously dependent upon the catheter are enabled to urinate voluntarily again.

In spite of the good results attained through prostatectomy, there are certain grave objections to the operation. The subjects of enlarged prostate are always advanced in years, and, as a rule, their vitality is at a low ebb. Prostatectomy is a serious operation and attended with a very considerable amount of shock.

In the days following the operation the patient is exposed to the dangers of ether-pneumonia, to which old people are liable, and to the risks of septicæmia from infiltration of urine into the wound, or uræmic poisoning from a failure of secretion on the part of the kidneys.

On these accounts prostatectomy should never be undertaken in the case of a debilitated, feeble old man, or in one who has marked atheromatous degeneration of the arteries.

Even in selected cases, although the results, as far as restoration of the bladder functions are concerned, are better than after the other operations, the mortality is higher, and ranges from 11 per cent. (Predal) to 20 per cent. (Watson).

Another contra-indication to prostatectomy is a hard, *fibrous* condition of the prostate. If the prostate is in this state, it is difficult or impossible to enucleate it, and some other surgical procedure must be adopted.

CASTRATION.

The danger to life and the difficulty of performing the various operations of prostatectomy have led surgeons to seek for other means of removing the obstructing prostate.

In 1893 J. William White, of Philadelphia, first published the results of his experiments, showing that the removal of both testicles caused an atrophy and shrinking of the prostate.

Velpeau and Sir Henry Thompson called attention, years ago, to the similarity between the fibromyomata occurring in the prostate and those of the uterus. Following up this suggestion, White castrated a number of dogs, and found that the operation was in every case followed by a rapid atrophy, first of the glandular structures of the prostate and then of the muscular elements.

The theoretical grounds upon which White accounts for the diminution in size of the prostate are as follow:—

The prostate in the man, although not embryologically the true homologue of the uterus, is developed from tissues quite distinct from those which go to form the urinary passages.

The structure of the prostate and the uterus is similar, as they are both hollow muscular organs containing glandular follicles.

The normal growth of the prostate is in direct relation to the sexual life of the individual, and its overgrowth occurs at a period when the sexual life is fading out, but is usually not extinct.

The reproductive powers of life end sooner in the female than in the male, and, on this account, fibroid tumors of the uterus appear earlier in women than do prostatic growths in men.

The histology of uterine and prostatic growths are notably similar in both sexes.

The uterine tumors do not appear after the menopause, and if already present undergo atrophy with the cessation of menstruation.

The prostate in men does not continue to increase in size after a certain time of life is reached, but has a tendency to grow smaller.

In the female removal of the ovaries causes the uterine fibromyomata to disappear, and the uterus itself undergoes an atrophy as well, and, in the male, removal of the testicles has a similar effect upon the prostate.

Diminution in Size of the Prostate.—The first effect upon the prostate of the removal of the testicles is to cause a rapid disappearance of the congestion, which reduces the gland somewhat in size. This slight reduction in bulk often relieves the obstruction and the patient can sometimes urinate spontaneously a few hours after the operation of castration.

The experiments on dogs and autopsies upon men have shown that a true atrophy of the gland takes place from absorption and disappearance of its glandular structure, which occurs first and is followed later by the partial disappearance of the connective-tissue stroma which lies between the glandular elements.

These changes may require a few weeks or from four to six months before they are completed; so that we should not be disappointed if after castration several months elapse before any good results are manifested.

The general indications for castration are the same as for any of the other operative procedures, viz.: "approaching break-down in catheter-life."

Castration, however, is particularly adapted to the cases of large, soft, elastic prostates, congested with blood and containing a good deal of glandular tissue.

The prostates which have advanced to the second stage of hypertrophy, in which the glandular tissue has disappeared and has been replaced by connective tissue, causing the prostate to become hard and of a dense consistence, are unfavorable cases for castration, and, while good results sometimes follow from the decongestion of the organ, the fibrous residue of the prostate does not shrink after the operation.

Clinical Results of Castration.—Castration has now been done for the relief of hypertrophied prostate in hundreds of cases, and the results of the operation have been closely followed by many different observers. The statistics of 111 cases of castration, which were collected by White, showed that a rapid atrophy of the prostatic enlargement occurred in 87 per cent. There was a disappearance or lessening of the long-standing cystitis in 52 per cent., a return of vesical contractility in 66 per cent., and an amelioration of the most troublesome symptoms—viz.: inability to pass water, frequent urination, and painful urination—in 89 per cent. of the cases.

It will be noted that in Dr. White's table the vesical contractility was restored in 66 per cent.

Fenwick takes the ground that, if a bladder has been crippled for three years or more by severe cystitis and entirely incapable of being emptied except by the catheter, it is highly probable that, even if the prostate shrink, after castration, the muscular fibres of the bladder will be so atonied that the catheter can never be dispensed with, although its introduction will be easy.

In connection with this view it is interesting to note that Bruns reports 28 cases in which the catheter had been used from a few months up to two years and in which voluntary urination was restored in 22 cases.

In 20 cases in which the catheter had been used from two to twenty years spontaneous urination returned in 8 of them after castration.

The *cystitis* is reported as improved in 52 per cent. of White's cases, and the improvement is accounted for by the possibility of the bladder being completely emptied of its residual urine, owing to the reduction in size of the prostate and also from the relief of the passive hyperæmia in the prostatic plexus of veins and the mucous membrane of the bladder-walls.

In 1897 Englisch published tabulated statistics of 202 cases of castration, which had been performed by various surgeons. Of these, in 147 only were the details stated with sufficient fullness to make them worthy of record. Englisch finds that the *age* of the patient has but little influence upon the result, but the amount of prostatic obstruction, the quantity of residual urine, and the state of the kidneys bear a direct relation to the mortality of the operation. In these cases, as reported, of 106 patients operated upon, who suffered *with* retention of urine, 23 per cent. died, and, of 18 patients *without* retention, only $5\,{}^1/_2$ per cent. died. The state of the bladder and kidneys is a still more important consideration in the result. Of 47 patients with severe cystitis who were castrated, 20 died, 2 were cured, and 19 were improved; of 46 patients with slight cystitis, 4 died, 20 were cured, and 20 were improved. In 110 cases a successful result was shown by reduction in size of the prostate and an improvement in the accompanying symptoms in 69 of them. A reduction in the size of the prostate without an improvement of the symptoms was noted in 6 cases, and an improvement in the symptoms without reduction of the size of the prostate in 27 cases.

The *mortality* of castration was found to be 34 deaths in 220 cases. In 14 of these it was not possible to attribute death to the operation, and in the other 20 death was almost invariably due to advanced disease of the urinary organs.

In 1898 Albarran and Motz collected and published statistics of 124 castrations. They divided the cases into four groups:—

(*a*) *Cases of dysuria, but without retention.* Of 14 cases of prostatic hypertrophy with these symptoms, 7 were cured and 4 were improved.

(*b*) *Cases of acute retention.* Of 20 prostatics with acute retention, 3 died soon after the operation and the other 17 quickly regained the ability to empty the bladder, and did not experience a relapse.

(*c*) *Cases of chronic partial retention.* Of 41 prostatics with chronic retention which was not complete, 4 died after castration, 19 were cured, 14 were improved, and in 4 the residual urine was not decreased in quantity, but the vesical tenesmus improved.

(*d*) *Cases of complete chronic retention.* Of 49 prostatics with complete retention, 10 died after the operation, 20 were entirely cured, 14 had a partial return of spontaneous urination, and in 5 there was no result.

In the acute cases of retention and dysuria the good results are attributed to the relief of the congested state of the prostate, and in the patients with chronic retention a diminution in the size of the prostate is brought about and at the same time the contractility of the bladder is increased.

It should be borne in mind that improvement does not follow after every castration, and it is generally conceded that the *hard, fibrous prostates* are the ones which do not atrophy after a removal of the testicles.

A careless diagnosis is responsible for a certain number of failures.

Various local conditions, such as a narrow meatus, a long prepuce, stricture of the urethra, and particularly a vesical calculus, all produce symptoms resembling those resulting from an enlarged prostate, and, indeed, may be present as complications. Therefore before proceeding to advise a castration all such conditions should be excluded by appropriate examination.

The ease and rapidity with which castration can be performed has also led to its being used as a last resource to relieve the distress of old men, who were nearly moribund and who were unfit to stand the slightest form of operative procedure. In such cases, of course, no relief can be expected from a castration, and the patient's inevitable death is only hastened.

Mortality of Castration.—On examining the statistical tables the death-rate of castration seems surprisingly high for such a simple operation. Of the 154 cases collected by Englisch, 16 per cent. died, 14 per cent. of Albarran and Motz's 154 cases died, and 18 per cent. of White's 111 cases resulted fatally.

This high death-rate may be explained by the fact that a number of patients were operated upon who were in a uræmic or even dying condition. White states that 13 of the fatal cases in his report died from existing kidney disease, and, if these are deducted, it will leave a death-rate of only 7 or 8 per cent., which he considers the legitimate mortality of castration. This view is also borne out by Englisch's tables. In 106 cases which he collected and who suffered from retention of urine, 23 per cent. died; while, of 18 patients castrated who had no retention, the mortality was only $5\,{}^1/_2$ per cent.

His tables also show the relation which disease of the bladder and kidneys bears to the mortality. Of 47 cases who had severe cystitis, 42 per cent. died; while, of 46 cases with but a slight degree of cystitis, only 8 per cent. were fatal.

In Albarran and Motz's cases, of the patients with acute retention of urine, 15 per cent. died; of those with chronic complete retention, 20 per cent. died; while with those of partial retention the death-rate was only 9 per cent.

Remote Results of Castration.—A small number of patients after being castrated developed delirium, or a condition resembling senile dementia, and it was formerly thought that the removal of the testicles was responsible for this state, upon the supposition that the testicular secretion was necessary to the mental vigor and equipoise of a man. That view is now abandoned, and the delirium which occasionally follows a castration is supposed to be either traumatic or uræmic in origin, as a similar form of delirium is known to occur at times after any surgical operation upon an aged person.

From the opportunities which have been afforded in the Orient, from times of earliest antiquity, to observe the eunuchs, it is highly probable that the mere removal of the testicles will have but little influence on the mental force of the man. Curvan states that, in the East, the eunuchs are shrewd and sagacious mentally and vigorous in body, with the exception of those who are degraded by practices of sexual perversion.

VASECTOMY.

The disinclination of patients to allow the removal of their testicles has led surgeons to endeavor to cause an atrophy of the prostate by means of ligating the spermatic cord through an incision in the scrotum.

Experiments on animals show that, when the spermatic cord is divided, the prostate sometimes grows smaller. The decrease in size is accounted for by a lessening of the congested condition of the gland, which takes place immediately after the operation.

In two anatomico-pathological examinations of prostates made some time after the operation, no atrophy of the gland was discernible, although the contractility of the bladder had been improved by the operation.

Albarran and Motz collected the following statistics of the operation of vasectomy: In 47 cases 7 deaths followed the operation. A diminution in the size of the prostate occurred in 21 cases, which was due to the effect of the operation in causing a decongestion of the gland. In some of the cases a subsequent examination showed that the diminution in size was only temporary, lasting about a month. Vasectomy exerted little influence upon the contractile power of the bladder. In 11 cases of acute retention 3 were cured and 5 improved. In 40 cases with dysuria, or incomplete retention, 4 were cured and 5 improved; and in 19 cases of chronic complete retention 3 were cured and 3 improved, 5 died, and 8 were without results.

From these studies Albarran and Motz conclude that resection of the vasa deferentia is often followed by a lessening of the congestion of the prostate, which causes its volume to diminish temporarily, and evokes an improvement of the dysuria, the cystitis, or the retention, from which the patient suffers.

There is nothing to prove that the operation causes an atrophy of the hypertrophied prostate, or that in cases of chronic incomplete retention the residual urine is diminished if the operation is made at a time when the prostate is not congested. There are also no records to show that after the operation the bladder is able to empty itself.

PALLIATIVE OPERATIONS.

In these operations no attempt is made to remove any portion of the prostate. They are done for the sole purpose of draining the bladder, treating the cystitis, and avoiding catheterization.

The bladder may be drained by means of

(*a*) Perineal opening. (*b*) Suprapubic cystotomy.

The perineal incision is the operation of choice when it is desired to drain the bladder *temporarily* for the sake of giving a respite to the urethra which has been irritated by the hourly passage of a catheter, or to remove blood-clots from the bladder which have originated from hæmorrhage into its cavity.

In cases of severe and obstinate cystitis the perineal opening and continuous drainage serve to clear the bladder from the thick mucopurulent urine and to restore the vesical mucous membrane to a healthy state and the urine to its normal *acid* reaction.

The perineal incision is a less serious operation than suprapubic cystotomy; the danger to life is not as great, and an opportunity is also offered to search the bladder with the finger, and, if a small stone is found, it can be removed.

The prostatic urethra is stretched and dilated with the finger at the same time, and a large catheter is introduced through the wound and kept in the bladder for from one to three weeks, draining it of its residual urine and allowing it to be washed out and kept clean and aseptic.

The drainage of the bladder gives great comfort. The patient is not aroused from sleep every few minutes to pass water. The tenesmus and pain on urination are no longer felt, the cystitis subsides, and the prostatic œdema lessens. Sometimes spontaneous urination follows. After the drainage is discontinued the introduction of a catheter becomes easy.

Unfortunately, however, drainage through the perineum cannot be kept up indefinitely. The posterior urethra becomes irritated and resents the presence of the catheter after a few days, and so much pain and spasm are caused by it that the catheter has to be removed.

In such cases, when the drainage is still required, we must have recourse to another mode of accomplishing it: *i.e.*,

Suprapubic Cystotomy.—An opening made into the bladder above the pubes gives an opportunity to inspect the cavity of the bladder and remove a calculus if present, and if the stone happens to be in a saccular dilatation it can never be found in any other way.

The suprapubic fistula answers very well as a permanent opening and is more easily managed by the patient than the perineal opening. A tube is arranged to pass through the fistula, in the abdominal wall, into the bladder, siphon off the urine, and allow it to flow into a reservoir under the clothing (the Bloodgood bladder-drain). The patient wearing such an apparatus is able to be up and about, even to take long walks and enjoy a fair amount of activity.

Puncture Through the Substance of the Prostate with a Trocar.—In cases where there is an imperative necessity for draining the bladder, but for some reason the retention of a catheter in the urethra is impracticable, drainage may be accomplished by plunging a trocar into the perineum and through the substance of the prostate, as suggested by Reginald Harrison.

A catheter is introduced into the bladder through the cannula of the trocar and left in, and the cannula is withdrawn. A serious objection to this form of tunneling the prostate is the danger of the septic urine leaking into the substance of the prostate through the wound, and causing parenchymatous suppuration.

CHOICE OF OPERATIONS IN HYPERTROPHIED PROSTATE.

The knowledge which we possess at the present time, of the relative worth of the various operations, is too indefinite to enable us to lay down any hard-and-fast rules for the selection of the procedure best adapted to relieve a particular case.

There are certain conditions which differ in each individual, and which have to be carefully considered before selecting the operation which seems most applicable to the case in hand.

POINTS FOR CONSIDERATION.

I. General Conditions.—(*a*) The age of the patient.

(*b*) The state of his general strength.

(*c*) The condition of his sexual powers.

(*d*) The state of his kidneys.

(*e*) The amount of atheroma in the arteries.

II. Condition of the Prostate and Bladder.—(*a*) The size and density of the prostate.

(*b*) The form of the obstruction: whether it is in the form of a bar across the vesical outlet, a tumor deflecting the urethra, or a mass the size of an orange filling up the pelvis.

(*c*) The condition of the bladder in relation to its atony or hypertrophy.

(*d*) The quantity of residual urine.

(*e*) Catheterization, its ease, or if attended with pain and bleeding, and its necessary frequency.

(*f*) The severity of the accompanying cystitis.

III. Complicating Conditions.—(*a*) Vesical calculus.

(*b*) Stricture.

(*c*) Diabetes.

For the better selection of an operation it is useful to adopt the classification of prostatic cases suggested by J. William White.

Class A.—Patients with moderate enlargement of the prostate, who suffer little or no pain, and with clear residual urine to the extent of three or four ounces. For these cases no operation is to be thought of, and they get on very well with methodic catheterism. But in time, as these difficulties increase, they come into Class B.

Class B.—These patients suffer with marked obstruction from the prostatic overgrowth at the vesical outlet. The prostate ranges in size from one and one-half inches in diameter to three inches (about the size of a lemon). The residual urine may be eight or ten ounces in amount, or there may be complete retention. The cystitis is marked, and the urine is purulent, ammoniacal, and fœtid. Operative interference of some kind is clearly indicated, and the choice lies between prostatectomy, castration, and Bottini's operation.

If the patient is strong and vigorous, with active sexual powers, and is free from atheroma and with sound kidneys, and if the hypertrophy is glandular in character, causing the prostate to be soft and elastic and of large size, prostatectomy may be considered, although it should be borne in mind that even in skilled hands the death-rate ranges from 11 to 20 per cent.

If the patient is older and more feeble, and has atheroma or diseased kidneys, Bottini's operation or castration would be the operation of choice.

Bottini's operation appears to be indicated particularly in the patients with hard, dense, fibrous prostates, for castration has but little effect in causing this variety to shrink.

The soft elastic prostates give the best results after castration, although Bottini's operation may be applied in these cases also.

The choice between Bottini's operation and castration is sometimes determined by the form of the obstruction, which may be demonstrated by a cystoscopic examination.

Class C.—In this class the prostate is as large as a base-ball or small orange. Retention of urine is nearly or quite complete, and catheterization is difficult and painful. The kidneys are usually diseased, and atheroma is extensive. In these cases castration probably offers a better chance of relief than any of the other operations.

Class D includes the desperate cases with enormous prostates and excessive cystitis. The bladder is dilated and saccular, the retention complete, and catheterism difficult. These patients are advanced in years, and suffer from chronic urinary fever. The kidneys are diseased, and atheroma is extreme. Any surgical operation is attended with great danger, but the patients' suffering is so great that they are willing to accept any risk for the sake of relief. In these cases the choice of operation would lie between the establishment of permanent drainage of the bladder through a fistula, preferably suprapubic, or castration.

Dr. White says: "Castration offers more hope of material benefit, with less risk, than any other operation, although, of course, the mortality is high. It occasionally fails to do good; but, on the other hand, I have seen an improvement and many cases have been reported that were simply marvelous, cystitis vanishing and the power of voluntary urination returning in patients in whom such results would have been thought almost beyond the limits of possibility."

Diabetes is regarded as debarring all operations unless catheterization is impossible. In such cases permanent drainage through a suprapubic fistula affords the best means of relief.

For the purpose of presenting the statistical material which has been collected, in a tabular form, Wossidlo has arranged the following table, in order to compare the results of the various operations:

MODE OF TREATMENT.	NUMBER OF CASES.	CURED	IM-PROVED.	NO RESULT.	DIED.
		Percentage.	Percentage.	Percentage.	Percentage.
Methodical treatment . . .	92	18	45	3	32
Castration	154	27	47	9	16
Vasectomy	116	21	53	18	6
Bottini's operation	110	59	13	18	8

In the course of time, as our knowledge is increased through experience, it is fair to assume that, by a judicious selection of the operation for each individual patient, we shall be able to reduce the number of cases in which there is no result or but slight improvement, and that our efforts will be more uniformly certain of complete success than at the present time.

CHAPTER XV.

TUBERCULOSIS OF THE PROSTATE.

THE prostate is involved in nearly every case of genito-urinary tuberculosis. Of 26 cases of tuberculosis of the prostate reported by Socin, in 24 of them other genito-urinary organs were affected and only in 2 did the genito-urinary apparatus escape. In these two instances the lungs and bones were the seat of tubercular deposits.

Although Sir Henry Thompson denied that the prostate could ever be the seat of *primary tuberculosis*, later investigators have proved conclusively that it may be, and Desnos and Krzwicki even go so far as to state that, in their opinion, in most cases of genito-urinary tuberculosis the prostate is the organ which is first infected with tubercle bacilli, and from that focus the infection subsequently travels to the adjacent structures. This point is important to bear in mind in connection with the operative treatment, which will be considered later.

The *time of life* at which tuberculosis is most apt to fasten upon the genital organs is that period at which sexual activity is most highly developed, and consequently we find that our patients are usually between twenty and forty-five years of age.

Predisposing causes play an important rôle in the etiology of tuberculosis of the prostate. Anything which induces prolonged and oft-repeated congestion of the posterior urethra weakens the resistance of the tissues; consequently a tubercular outbreak is more liable to occur in the person of a young man who has practiced some form of sexual abuse or has been the subject of a prolonged attack of gonorrhœa of the posterior urethra. But this in itself is not sufficient to cause the disease, and to bring this about the tubercle bacilli must be actually introduced into and develop in the substance of the gland.

As to the **modes of infection,** the micro-organisms are most frequently brought to the prostate in the blood-circulation, often from a tubercular deposit in some distant organ. In other cases they may be taken into the body through the respiratory or alimentary tracts, and, passing along with the blood-current, be ultimately deposited in the prostate.

The inoculation of bacilli, however, may be direct, and be occasioned by an infected catheter or through coitus with a tuberculous female, or the prostate may be infected by a process of extension from some neighboring organ.

PATHOLOGY.

A deposit of tubercle takes place in the substance of the prostate, and either one or both lobes are affected. The tubercular nodules are multiple from the beginning, or else soon become so, and they enlarge until several coalesce, when they break down and form abscesses.

Unless removed by operation, the pus bursts through into the rectum or urethra or even the hypogastrium, and multiple fistulous tracts are formed. In rare instances the cheesy mass becomes the seat of calcareous changes, or the fluid portion of the mass is absorbed and the residue is encapsulated, and a healing of the lesion results.

It is important to note that the bladder and seminal vesicles are always involved sooner or later in the course of the disease. The epididymis is also affected, although in many cases this organ is the first attacked, and the infection extends to the prostate subsequently.

SYMPTOMS AND COURSE.

If the process begins in the central part of the prostate, no definite symptoms are caused; but if the nodules are located superficially, and cause a bulging of the prostate toward the rectum, a sense of weight in the perineum and difficulty in defecating is experienced.

If, on the other hand, the tubercular foci lie close to the urethra, the symptoms are those of posterior urethritis, viz.: frequent and urgent urination, accompanied by a muco-purulent discharge from the urethra and shreds in the urine.

There is no distinct pain after the act of micturition, but a feeling as though the bladder were not fully emptied.

Defecation spermatorrhœa sometimes occurs if the deeper-lying prostatic tubules are infiltrated with nodules, and another form of secretion from the meatus is occasioned by the breaking down and discharge of small abscesses through the urethra.

Hæmaturia is a frequent symptom, and is not constant, but intermittent. The blood comes at the end of urination, and is not due to an ulceration of the urethra, as formerly supposed, but merely to the congestion of the prostate.

In uncomplicated cases *pain* may be excruciating, and is sometimes so severe that it overshadows all the other symptoms.

As the disease progresses the bladder is always affected. This is announced by the occurrence of pain after urination and tenesmus, and as the cystitis grows worse the bladder symptoms become the marked feature in the case.

In most cases of tuberculous prostatitis death is caused by an ascending infection, involving first the bladder and subsequently the kidneys, or the lungs may be attacked, or a general miliary tuberculosis may be established.

In a few rare instances the disease remains limited to the prostate; an abscess forms, which breaks and discharges, the cavity cicatrizes, and a cure follows.

DIAGNOSIS.

On rectal examination the tubercular prostate will be found enlarged in one or both lobes. The enlargement is distinctly nodular or lumpy, and at first of a stony hardness. After the abscess forms points of softening with fluctuation can be readily felt.

It is often extremely difficult, indeed sometimes impossible, to determine whether the enlargement is in the prostate or involves the seminal vesicles, for these different organs may be so blended together by the inflammatory exudation that the lines of demarcation cannot be defined. On this account it was formerly supposed that every tubercular process in this region was confined to the prostate, whereas we now know it to be true that the tubercular process may attack prostate and vesicles together, or either organ be involved alone.

The gonorrhœal inflammations of the prostate, chronic prostatitis, or the acute suppurative form resembles in physical signs the tuberculous disease, and it is impossible definitely to establish the diagnosis of tuberculosis until the presence of tubercle bacilli has been demonstrated in the secretions. These may be collected by expressing, with the finger in the rectum, the secretions from the prostate gland; and the bacilli are also generally present in the discharge from the meatus which so often exists.

If no tubercle bacilli are found in examining the secretions, guinea-pigs may be inoculated with the discharges, and, if the pig develops tuberculosis, the diagnosis is, of course, established.

In cases of general tuberculosis it is usually safe to consider every enlargement of the prostate tubercular in character, and the only difficulty in diagnosis arises in the cases where the prostate is the seat of primary tuberculosis.

PROGNOSIS.

The prognosis is, of course, of the gravest, although when the tuberculosis is limited to the prostate alone spontaneous cure sometimes occurs through healing of the cavity after the abscess has formed and burst.

Unfavorable elements in the case are an hereditary predisposition to tuberculosis and a tendency for the disease to extend and involve other organs.

TREATMENT.

The general treatment consists in endeavoring to vitalize the tissues by means of a life in the open air or a prolonged sea-voyage, abundance of nourishing food, and the administration of codliver-oil, creasote, guaiacol, and other antitubercular remedies.

There is a difference of opinion as to the advisability of beginning local treatment early. In general, it is better to avoid instrumentation, for the reason that the local resistance of the tissues is reduced, and infection of the bladder with other micro-organisms readily occurs.

On the other hand, instillations into the posterior urethra in the early stages have their advocates. Guyon advises sublimate sol., 1-5000 to 1-3000; and iodoform in glycerin is warmly recommended by Berkeley Hill. Everyone is agreed that nitrate of silver uniformly acts badly, and its use is contra-indicated.

After cystitis has set in the principal indications are to control the pain and tenesmus, but these matters have been considered in another section. (See "Cystitis.")

Under the head of **operative treatment** may be considered, first, the suggestion of Hoffmann, which was to inject 10-per-cent. emulsion of iodoform and glycerin into the substance of the prostate by means of a long needle thrust in through the perineum. This procedure has never gained favor, and is to-day practically abandoned.

A few years ago, when the *dictum* of Sir Henry Thompson, that "tuberculosis of the prostate was never primary, but always secondary to deposits elsewhere," was accepted as final, it was thought useless to attempt to extirpate the diseased prostate, and the rule was only to operate when pus had formed, in order to evacuate the contents of the abscess.

At the present time the opinion has changed, and the operation of laying bare the prostate by a semilunar incision curving around the rectum and removing all the diseased tissue with a curette commends itself as a rational and conservative procedure, and one which is likely to bring about a radical cure, when the disease is limited to the prostate alone.

When the prostate is secondarily affected, and deposits exist in other organs, the indication for operation is not so clear, but even in these cases an operation is likely to save the patient the misery and suffering from a prolonged course of suppuration of the prostate, with the slow formation of fistula.

DISEASES OF THE KIDNEYS.

CHAPTER XVI.

MOVABLE KIDNEY.

An unnatural movability of the kidney occurs in two forms:—

(a) **Movable kidney** is more frequent in its occurrence than the other form. In this variety the kidney moves about freely behind the peritoneum, as it lies in a sort of pouch or cavity formed within its own fatty capsule.

(b) **True floating kidney** lies closely surrounded by its fatty capsule, and is supplied with a mesonephron, which is attached by one end to the spinal column, but which is so long that it allows the kidney to float about freely in the peritoneal cavity. The extent of the excursions of the kidney depends only upon the length of its mesonephron.

ETIOLOGY.

Movable kidney occurs more frequently in females than in males, Lindner finding that 1 out of every 5 or 6 women examined were so affected, and the right kidney is more frequently movable than the left.

True floating kidney is either caused by a congenital mesonephron or it may exceptionally be the last stage of a movable kidney.

Various reasons are suggested for the preponderance of movable kidney in the female, the chief of which are laxity of the abdominal walls as a result of child-bearing. On closer scrutiny, the facts do not uphold this theory, for a movable kidney is found as often among virgins and nulliparæ as among women who have borne children.

It is probable, however, that the cause of movable kidney in both sexes is the absorption of the fat which surrounds the kidney and acts as a cushion and support to it, as a consequence of the emaciation occurring in wasting diseases.

If the fat is absorbed, a slight blow or muscular strain, such as the exertion of vomiting, may be enough to loosen the kidney from its attachment and permit it to move about more or less freely.

SYMPTOMS.

The symptoms of movable kidney are, of course, obscure. Gastro-intestinal symptoms, such as flatulence and dyspepsia, are generally present, and have been accounted for by the supposition that the kidney in its abnormal situation exerts pressure upon the duodenum and narrows its lumen, thus causing partial retention and fermentation of its contents.

Edebohls considers these symptoms due to pressure and traction upon or stretching and irritation of fibres of the solar plexus, lying in the abdomen and belonging to the sympathetic nervous system, because it would seem that the theory of obliteration of the lumen of the duodenum is insufficient to account for the symptoms.

Edebohls calls attention to the other symptoms which are generally caused by floating kidney, as follows: Pain is felt in the epigastrium, which is not increased by pressure, and is located somewhere to the left of the median line at or near the free border of the left costal cartilages. General nervousness in greater or less degree exists, and is usually accompanied by cardiac palpitation and habitually rapid action of the heart.

These patients are also unable to sleep or to rest comfortably while lying upon the left side.

In true floating kidney with a long mesonephron in addition to the presence of the above-mentioned disturbances the patient is conscious of abdominal pains, of a dragging or pulling character, and the sensation is felt as if some foreign body were moving about in the abdominal cavity, particularly after a sudden muscular exertion, or upon rising up suddenly after lying down.

The pain may be only wearing in character or it may occur in paroxysms and be agonizing. Its onset is sudden, and it is apt to follow fatigue or active exertion. The pain in some cases is due to attacks of local peritonitis.

Nervous disturbances, hypochondria, melancholia, and hysteria usually occur, either as reflexes or from disturbances of nutrition. The secretion of urine by the misplaced kidney is, in general, not interfered with.

DIAGNOSIS.

The diagnosis is not difficult to make in thin subjects with relaxed abdominal walls. By palpating the flank between the fixed border of the ribs and the crest of the ilium the displaced kidney can be felt between the two hands.

In fat subjects the diagnosis presents greater difficulties. If the kidney has been displaced into the pelvis, it may be mistaken for an ovarian or fibroid tumor; but the kidney may be differentiated by replacing it with ease in its natural position in the flank, while the attachment of its mesonephron prevents its complete descent into the pelvis.

If the mesonephron is shorter and the kidney is found lying in the abdomen, it might be looked upon as a distended gall-bladder, enlargement of the spleen, or a tumor of the omentum.

PROGNOSIS.

A kidney which once becomes movable never again becomes firmly fastened in place, except by operative interference.

A misplaced kidney, however, is, in general, not fatal to life, and, if death occurs, it is usually the result of exhaustion from chronic dyspepsia, continued pain, and nervous depression, although death is sometimes due to malignant disease developing in the displaced organ.

TREATMENT.

The symptoms of movable kidney may be ameliorated by lying in bed, by the Weir Mitchell treatment, and by massage and electricity; but none of these methods offer much prospect of permanent relief (Edebohls).

A simple bandage of elastic webbing without any pad over the kidney and which, encircling the whole abdomen, makes as much pressure as the patient can comfortably bear, helps to support all the abdominal viscera and with them the kidney. Such a method may be tried before proceeding to operation, but it is generally found to be ineffective in holding the kidney in place.

On account of the difficulty of retaining the kidney in position, nephrorrhaphy, or fixation of the kidney, is advised by Edebohls as the first resort in patients with movable kidneys which produce decided symptoms.

Nephrorrhaphy is an operation which is not attended with much danger to life and it is generally successful in fixing the kidney and relieving the symptoms. Delvoie reports 215 cases operated on by fixation, of which 135 were cured, 30 improved, 25 unimproved, 20 relapsed, and 5 died.

Nephrectomy, or total removal of the kidney, has no justification when the kidney has only a small range of motion, and the operation is accompanied by a very high mortality.

In cases of true floating kidney with a long mesonephron it may be impossible to fix the kidney in place. Such a contingency would demand nephrectomy by the lumbar incision if possible, and, if this is not practicable, by means of a laparotomy, although the mortality is much higher with the abdominal route than when the kidney is removed through the flank and without opening the peritoneal cavity.

RENAL CALCULUS.

The formation of stone in the kidneys is of frequent occurrence, and often precedes vesical calculus. Stones composed of uric-acid crystals are most common, and the next in point of frequency are oxalic stones. Phosphatic calculi are rare, and are caused by the alkaline decomposition of urine as a result of pyogenic infection.

The stones are found in the pelvis of the kidney, and may be single or may be in hundreds.

ETIOLOGY.

The causation of kidney stone is generally the gouty diathesis (see "Vesical Calculus"). A few crystals are agglomerated in one of the renal tubules upon some substance, such as a blood-clot, coagulum of pus, or roughness of the wall, which serves as a nucleus. The agglomeration is washed out into the pelvis of the kidney, where it becomes the nucleus of a calculus.

The stone, if single, may be adherent to the walls of the pelvis of the kidney, or it may be movable and act as a ball-valve, closing the mouth of the ureter. The urine is dammed back, in consequence causing *hydronephrosis*.

Infection with micro-organisms usually occurs, and suppurative nephritis follows.

SYMPTOMS.

A stone may be present in the kidney for years without causing much discomfort, as the symptoms are due, not to the mere presence of a foreign body, but to obstruction. They are as follow:—

(*a*) Attacks of renal colic.
(*b*) Pain.
(*c*) Hæmaturia.
(*d*) Pyuria.
(*e*) Disturbances of urinary function.
(*f*) Gastro-intestinal disturbances.
(*g*) Passage of fragments of calculi.

Attacks of renal colic are strongly indicative of kidney stone, although typical paroxysms may be induced by other causes, and not infrequently renal stone has been diagnosed and operated for and its absence demonstrated on cutting open the kidney.

Renal colic is caused by the stone being forced out of the pelvis of the kidney and entering the ureter. An attack comes on abruptly, and is characterized by agonizing pain, which is felt in the loin, and radiates down into the testicle and along the inner side of the thigh.

The pain may also radiate through the abdomen and chest, and be very intense in the back. In severe attacks nausea and vomiting occur, the pulse is feeble, the skin is covered with a cold sweat, and the patient is in a state of collapse.

In lighter cases urination is frequent, and the urine discolored with blood, or the patient may be unable to empty his bladder.

In rare cases the secretion of urine may be entirely suppressed either from (*a*) reflex disturbance of the secreting kidney; (*b*) extensive disease of the other kidney, whose ureter is not blocked; (*c*) where only one kidney exists in the body.

In these cases uræmic symptoms develop after a week, and death takes place within a fortnight after the obstruction.

The pain and disturbance of ureteral colic may last for a few minutes or for a number of hours, and usually ceases abruptly as the stone either drops back into the pelvis of the kidney or makes its escape from the lower end of the ureter and enters the bladder.

The stone occasionally becomes permanently fixed in the ureter, in which case, after some time, the walls give way slightly around it, permitting a portion of the urine to pass by; but the urine is dammed back upon the kidney, and *hydronephrosis* is developed.

Pain is felt over the affected kidney, which is increased by motion, jarring, and pressure over the side.

The sensation is that of a feeling of weight, rather than of acute pain, but the patient is liable to have paroxysms of acute pain, which often occur at night, when he is at rest in bed.

The pain radiates along the ureter and into the testicle, and often causes contraction of the cremaster muscle, with drawing up of the testicle on the affected side. The pain may be referred to the healthy kidney or to the bladder, thigh, or calf of the leg.

Hæmaturia occurs most frequently when the stone is passing through the ureter, but may appear when the stone is in the pelvis of the kidney.

The bleeding may come on in a slight amount, giving the urine a smoky color, or the urine may be free for days until, after some sudden exertion or a prolonged ride, a considerable amount of bleeding takes place.

Pyuria occurs only after suppurative disease of the kidney has occurred, but this is usually established in time.

Disturbances of Urinary Function.—The irritative effect of stone in the kidney causes it to secrete an excessive quantity of urine by day when the patient is moving about, but at night, when he is quiet in bed, the secretion of urine is normal in quantity.

As a result of blocking the ureter with a stone, the urine may be diminished in quantity or entirely suppressed for a time. If it persists after the attack is past, it is clear either that the ureter of the functionating kidney is blocked with a stone and that the other kidney is so much diseased that it is not capable of secreting or else that there is only one kidney present.

Occasionally the obstruction develops insidiously without attracting attention until symptoms of uræmia set in.

Gastro-intestinal disturbances may be reflex in origin or may result from imperfect elimination by the diseased kidneys. Dyspepsia, vomiting, and epigastric tenderness may easily cause the condition of the kidneys to be overlooked.

Passage of fragments of calculi is very often absent, or the fragments are overlooked by the patient, but when present it is of great value in indicating the presence of kidney stone, even though colic was not caused by the passage of the fragments through the ureters.

DIAGNOSIS.

A positive diagnosis of renal calculus is difficult to make, and many cases are on record in which the kidney was incised for the purpose of removing a stone when none was present.

The most characteristic symptoms of kidney stone are passage of gravel or fragments of stone, attacks of typical renal colic, hæmaturia, and, in time, pyelitis.

Hæmaturia and pain are often caused by tubercular or malignant disease of the kidney, and oxaluria and strongly-acid urine occasion a dull ache over the kidneys or even paroxysms of pain, which are sometimes accompanied by hæmaturia.

Spinal caries of the lower dorsal vertebræ and locomotor ataxia may simulate the pain of kidney stone.

During an attack of renal colic it may be impossible to distinguish between the passage of a gall-stone or of a stone through the ureter.

Before attempting any operation it is, of course, essential to determine if both kidneys are affected or if the disease is confined to one side only. The location of the pain and tenderness on palpation throw some light as to which side the disease is located upon; but the question may be settled positively by catheterization of the ureters.

The x-ray has been of great use since its introduction in diagnosing cases of kidney stone, and is now regarded as one of the indispensable diagnostic aids.

As a final resort in the cases where stone is suspected and the patient's health is failing, it is justifiable to make an exploratory incision into the kidney by lumbar nephrotomy.

PROGNOSIS.

A stone may remain in the pelvis of the kidney for years without causing any serious disability, and only at times inducing transient pain or hæmaturia; but the patient is continually exposed to the danger of obstruction of the ureter and suppuration of the kidneys from pyogenic infection.

If a fragment of stone passes into the ureter, it usually escapes into the bladder, but if it become impacted in the ureter, disorganization of the kidney ultimately takes place, and the same is true if suppuration of the kidney occurs.

TREATMENT.

Attacks of renal colic are sometimes cut short by a prolonged hot bath and a full dose of morphia hypodermically.

In giving opium it is necessary to exercise caution and not give too large a quantity, for as soon as the stone is released and slips out of the ureter the pain ceases, and the patient may be overcome by the effect of the drug.

In cases which do not respond to morphia it may be necessary to secure relaxation by means of anæsthesia with chloroform or ether.

In the intervals of the attacks the general diathetic condition of the patient upon which the formation of stone depends should receive proper attention (see "Treatment of Stone in the Bladder").

But little success has been attained by efforts at dissolving stones. Piperazin in 5-grain doses taken in a pint of water three times a day is thought to have some effect in dissolving the albuminous framework of a uric-acid calculus, and phosphatic stones may perhaps be softened and broken down by Urotropin.

The most important point in the treatment, in addition to regulation of the diet and general hygiene, is to keep the urine abundant and of low specific gravity by drinking freely of pure spring- or distilled water.

Although a stone may remain for years in the pelvis of the kidney without danger to life, certain conditions—such as a deterioration of the general health, blocking of the ureter, or pyogenic infection of the kidney—call at once for the operation of *nephrolithotomy*.

This is indicated when the pain is persistent and severe, calling for the constant use of anodynes and accompanied by frequent attacks of renal colic and gradual emaciation and loss of strength.

Through a lumbar incision the kidney can be exposed and cut into, on its outer convex side, sufficiently to admit the finger into its pelvis, which can be thoroughly searched and the stone found and removed.

If the kidney has been the seat of prolonged suppuration and has undergone complete disorganization, nephrectomy (entire removal of the kidney) may be indicated.

PYELITIS.

In suppurative pyelitis, often called *surgical kidney*, the pelvis of one kidney may be attacked alone or both kidneys may be affected.

The **pathological change**, if due to an ascending infection, begins in the pelvis of the kidney, which becomes distended with pus, and if the ureter is blocked so that the pus cannot be discharged into the bladder, in course of time the interstitial secreting substance of the kidney is utterly destroyed and the organ is converted into a mere shell surrounded by its capsule and filled with pus. This condition is called **pyonephrosis.**

In **pyelonephritis** the suppurative process involves not only the pelvis, but the secreting structures of the kidney as well.

A number of small abscesses form between the tubules, and as they increase in size the intervening portions of tissue break down, so that several of the abscesses become merged into one.

The secreting parts of the kidney involved in the process are destroyed and the secretory function of the kidney is, of course, impaired.

After destruction of the kidney-substance the fluid portion of the

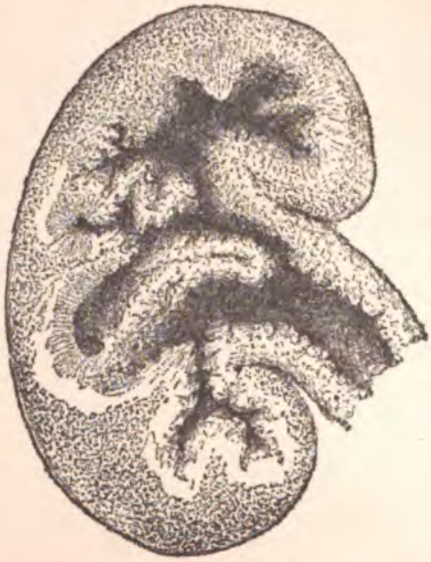

Fig. 73.—Tuberculous Pyelonephritis.

pus is often absorbed, and upon autopsy the kidney is found to be made up of several sacculi containing grayish, putty-like masses, which are often mixed with calcareous material.

ETIOLOGY.

Suppuration of the kidney is always caused by micro-organisms, of which the most frequent forms are the staphylococcus aureus and the colon bacillus, and in tubercular pyelitis the tubercle bacillus.

The modes of infection may be (*a*) *ascending*, caused by the passage of micro-organisms from the bladder upward through the ureters, and (*b*) *hæmatogenous*, in which case infective emboli occurring in sepsis, tuberculosis, or the infectious fevers are conveyed to the kidney through the blood-current.

Predisposing Causes.—The most important and frequent cause of pyelitis is inveterate cystitis from the retention of urine in the bladder behind a stricture or enlarged prostate.

The urine is dammed back upon the kidneys, causing a distension of the pelvis, and infection with micro-organisms which are conveyed through the ureters from the bladder readily takes place.

Renal calculi in themselves do not excite pyelitis, but the prolonged mechanical irritation to the kidney which their presence causes lowers its resisting-power and permits the entry of germs.

Infectious diseases—such as typhoid fever, pneumonia, scarlatina, small-pox, and general tuberculosis—lead to the formation of infectious emboli, which are carried through the general blood-circulation and are often deposited in the kidney.

SYMPTOMS.

As most cases of pyelitis are secondary to some other condition, the symptoms are obscured by those of the primary disease.

There are, however, certain definite symptoms which always accompany pyelitis:—

(*a*) *Changes in the Urine.*—Pus is always present in considerable quantities, although it often disappears for a few hours, from a temporary blocking of the ureter.

Blood is frequently present, and is increased by activity on the part of the patient. It may be uniformly disseminated through the urine or appear as long clots formed in the ureters.

TREATMENT.

In mild cases of pyelitis occurring in the course of an infectious disease the patient should be kept in bed, put on a milk diet, and large quantities of distilled water given by the mouth. Urinary antiseptics—Urotropin and salol—are indicated and citrate of potash should be administered to diminish the acidity of the urine as it lies in the pelvis of the kidney.

The *surgical treatment* includes the removal of any obstruction to the free escape of urine from the bladder, relief of the cystitis, the removal of renal calculi, and the evacuation of collections of pus in the kidney, *nephrotomy* and under certain conditions *nephrectomy*, or the removal of the kidney itself.

In pyelitis of gonorrhœal origin and in all acute cases which after a short time begin to show improvement, Caspar and Kelly suggest catheterization of the ureters and washing out the pelvis of the kidney with 3-per-cent. boric-acid or 1- to 2-per-cent. nitrate-of-silver solutions.

The indications for surgical operation are intermittent pyuria with fever during the intermissions and septicæmia, even though the pus constantly escapes through the ureter.

The operation indicated depends upon the extent of the destructive process in the kidney and whether one or both kidneys are affected.

I. One Kidney Alone Diseased.—(*a*) In the case of an abscess of the kidney, from a punctured wound or a renal calculus, it is desirable to drain as early as possible, in order to prevent destruction of the kidney-structures.

(*b*) If the entire kidney is infiltrated and riddled with abscesses, nephrotomy is first performed and the pus evacuated. It often happens that the patient's condition improves and the sinus heals up and the remains of the kidney can be left in place to be of some degree of service as an eliminative organ. In many cases, however, the kidney-structure has undergone so much disorganization that its extirpation is indicated, and, after the pus has been evacuated by an incision, the kidney may be removed a few days later by nephrectomy.

It is, in all cases, considered safer to allow an interval of a few days to elapse before removing the kidney entirely, except in cases of tubercular pyelitis, where the kidney should be entirely removed at the primary operation.

II. Both Kidneys Diseased.—In such conditions nephrectomy is out of the question, and in feeble old men, who are suffering from stricture or enlarged prostate, no operation can be undertaken which holds out much prospect of recovery.

If the patient is in better general condition, evacuation of the pus by incision (double nephrotomy) may relieve the septic condition, and, if the kidneys are not too much disorganized, they may be able to carry on their eliminative function sufficiently to maintain life.

HYDRONEPHROSIS.

When, from some mechanical obstacle in the ureter, the urine is prevented from flowing out from the pelvis of the kidney, retention of the non-purulent urine occurs, and the pelvis and calyces of the kidney become enormously dilated. Atrophy of its secreting substance takes place, with the formation of distinct cysts, which may attain to a very great size.

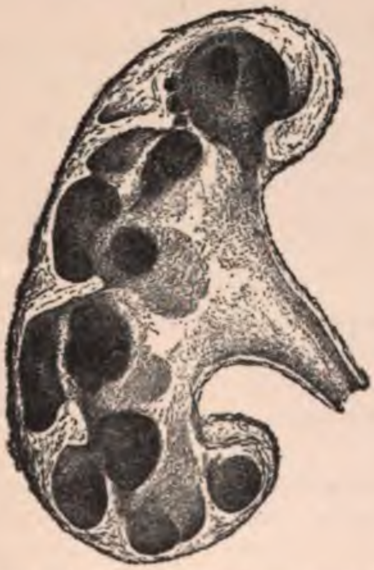

Fig. 75.—Hydronephrotic Kidney without much enlargement.

ETIOLOGY.

Congenital Causes.—The ureter may be entirely absent, or obliterated in some part, or the obstruction may develop after birth, on account of a twisting of the ureter or the formation of a valve-like fold, causing partial or complete closure of its lumen.

If an abnormal insertion of the ureter exists either at its origin from the pelvis of the kidney or at its entrance into the bladder, the angle of the insertion of the ureter may be so acute that it is compressed and its lumen closed when the patient is in the standing position.

Acquired causes operate either by compressing the ureter or obstructing the outflow of urine and causing it to be dammed back upon the kidneys. Tumors of the ovary and uterus, prostatic hypertrophy, and atony of the bladder will produce this effect at times.

A very frequent cause of hydronephrosis is a renal calculus, acting as a ball-valve, as it lies in the pelvis of the kidney at the mouth of the ureter, or if it enters the ureter and becomes fixed at any point in its course.

From any of these causes the obstruction may be *complete*, so that no urine can pass through the ureter; or it may be *incomplete*, and a portion of the urine passes through into the bladder.

Intermittent hydronephrosis occurs chiefly as a result of a movable kidney, as changes in the position of the kidney cause bends and twists in the ureter, and in consequence stagnation of the urine in the pelvis of the kidney, and ultimately dilatation with cystic formation.

The sac becomes completely filled, and then, if the obstruction is temporarily removed, it is emptied, and a large discharge of urine occurs into the bladder, and the hydronephrotic tumor disappears.

The obstruction in the ureter returns and the sac gradually refills, and after a varying time is again emptied.

The process of accumulation and discharge is repeated indefinitely unless the ureter becomes completely and permanently blocked, which usually occurs in the course of time.

SYMPTOMS.

The symptoms of hydronephrosis are vague and indefinite, and consist in the formation of a fluctuating tumor in the flank, which may be large enough to fill the entire abdominal cavity, together with frequent urination, and a diminution in the quantity of urine passed.

The symptoms caused by *intermittent hydronephrosis* are generally occasioned by a movable kidney, in which condition the ureter is obstructed by being bent at an angle.

The attacks are accompanied by violent pain and diminution in the quantity of urine and may easily be mistaken for an attack of renal calculus. When the kidney falls back into its normal place the ureter is straightened out, the pain ceases suddenly, and large quantities of urine are discharged.

PROGNOSIS.

Hydronephrosis may remain stationary for years, but the pressure of the accumulated fluid leads, in time, to an atrophy of more or less of the parenchyma of the kidney-substance, although the secreting structures are never entirely destroyed.

The affection is often complicated by infection with pyogenic organisms, and the case becomes converted into one of pyelitis, with its attendant dangers.

Large sacs have been known to rupture into the abdominal cavity and cause peritonitis, and, in a few cases of intermittent hydronephrosis, spontaneous cure has occurred.

DIAGNOSIS.

The diagnosis presents many difficulties, although a history of the sudden disappearance of a tumor coincident with the discharge of large quantities of urine is eminently suggestive of intermittent hydronephrosis.

An ovarian tumor is very liable to be mistaken for hydronephrosis. The distinguishing points are the situation of the kidney tumor in the flank, with the colon or small intestine in front of it.

Exploratory puncture of the tumor may throw some light upon the case, by furnishing a fluid containing urea or uric acid, but those ingredients of urine often disappear by absorption, and the liquid resembles that contained in any simple cyst. Catheterization of the ureters may settle the question of diagnosis by demonstrating if urine issues from one or both ureters and if it is clear or purulent

TREATMENT.

It is seldom possible to remove the obstruction in the ureter and re-establish the flow of urine through it, except when due to movable kidney or pressure upon the ureter from an abdominal growth, and the various attempts to do away with the obstruction by massage and ureteral catheterization, etc., have been rarely crowned with success.

In **double hydronephrosis** incision of both saccular kidneys by lumbar nephrotomy, with an interval between the two operations, and the establishment of a permanent fistula, although causing great inconvenience to the patient, affords the only hope of arresting the destruction of the secreting portions of the kidney and saving the life of the patient.

In **unilateral hydronephrosis** incision and drainage through the loin (nephrotomy) is the operation of choice, and later on, if the annoyance of the fistula becomes unbearable and the other kidney is found to be healthy, nephrectomy may be done upon the diseased kidney and the fistula allowed to close.

Before nephrectomy is undertaken it may be desirable to endeavor to remove the obstruction in the ureter by catheterization, or the advisability of transplantation of the ureters may be considered.

The operation of aspiration, or **lumbar puncture,** although formerly practiced, is seldom employed to-day, except in the cases where an operation is strongly indicated, but for some reason nephrotomy cannot be performed at the time.

In certain cases of intermittent hydronephrosis a permanent cure is said to have followed the operation of lumbar puncture.

When hydronephrosis depends upon a movable or floating kidney, nephrorrhaphy is indicated, and, when the kidney is fixed in place, the accumulation of urine and overdistension of the pelvis of the kidney may cease.

DISEASES OF THE TESTICLES.

CHAPTER XVII.

ECTOPY OF THE TESTICLE.

THE testicles are developed in the abdominal cavity of the fœtus. About the fifth month of fœtal life they begin to descend, and pass through the inguinal canal into the scrotum, arriving there about a

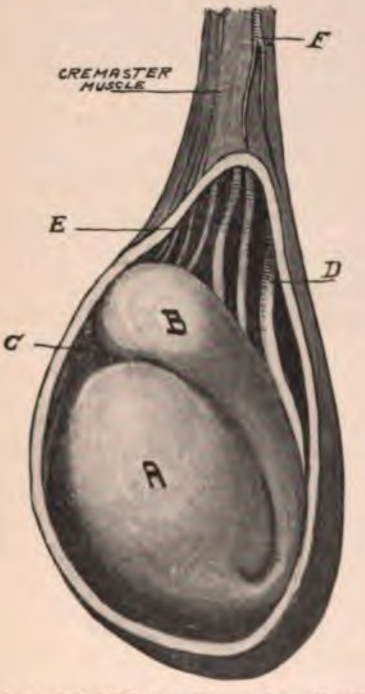

Fig. 76.—Testicle and Epididymis Exposed by Cutting away Part of the Tunica Vaginalis.

A, Testis.
B, Epididymis.
C, Tunica Vaginalis.
D, Vas Deferens.
E, Spermatic Artery and Veins.
F, Artery of Cord.

month before birth. One or both testicles may fail to follow the normal course, and may be retained:—

(*a*) In the abdomen (cryptorchism).

(*b*) In the inguinal canal.

(*c*) The testis may take an aberrant course and be found lodged under the skin of the abdominal wall, the thigh, or perineum.

ETIOLOGY.

The causes which operate to prevent the normal descent of the testes are obscure. It may be accounted for, however, by assuming that the external inguinal ring is of too small a size to allow the testicle to pass through it, or that the vessels accompanying the spermatic cord are too short to allow the cord itself to be stretched sufficiently to allow the testis to reach the bottom of the scrotum. If the testicle is held by a long mesorchium in the abdominal cavity its mobility may be so great that it slips past the opening of the inguinal canal without entering it.

The wearing of a truss, on account of a hernia, in a case where the descent of the testicle has been delayed after birth, will also prevent the testis from arriving at its normal place in the scrotum.

The causes of cruro-femoral and perineal ectopy are still more obscure. It is thought, however, that an overdevelopment of certain bands of the gubernaculum will have the effect of drawing the testis to one side and thus occasioning its aberrant course.

RESULTS.

The results of ectopy are impairment of the growth and development of the testis, so that it remains undersized, but probably possesses the power of forming spermatozoa, unless its structure is destroyed by attacks of inflammation, which are very liable to occur. After the testicle has been disorganized *sterility*, of course, follows.

COMPLICATIONS.

Hernia is a very frequent accompaniment, and if the testicle lies in the inguinal canal it interferes with the wearing of a truss, so that strangulation of the hernia is very liable to occur.

The testicle when not lying protected by the thighs, in the scrotum, is very liable to be struck and bruised, and the ectopic testicle rarely escapes several attacks of traumatic inflammation.

It is also subject to gonorrhœal inflammation from extension of a gonorrhœa from the posterior urethra.

Malignant disease is very apt to occur in the ectopic testicle, and is predisposed to by the attacks of inflammation to which the testicle in this situation is so liable.

DIAGNOSIS.

The diagnosis is made by (*a*) the absence of the testicle from the scrotum; (*b*) the detection of a smooth, oval, soft tumor in the inguinal canal, which moves up and down when the patient coughs and strains.

The testicle should not be mistaken for a hernia, which often complicates this condition.

TREATMENT.

In *intra-abdominal ectopy,* or cryptorchism, it is impossible to rectify the condition by operation, as the spermatic cord is too short to admit of placing the testis in the scrotum.

In addition, as the testicle is protected from traumatism, inflammation does not occur in it, and the dangers of destruction of its function, with consequent sterility or malignant degeneration, do not occur, and the chief reasons for operation do not exist.

In *inguinal retention* it is often possible by means of gentle manipulation to push the testicle into its proper place in the scrotum, and it may be retained in position by wearing a proper truss, which closes the ring and prevents its return.

If this procedure fail to retain the testicle in place, and the child is over six years of age, a surgical operation should be performed, for the reason that the testicle does not reach its full size and functional development while in an abnormal situation. From its exposed location it is also constantly liable to blows and injuries. These lead to repeated attacks of inflammation, causing sterility, and also predispose to malignant disease. The selection of the operation will depend upon the history of the case. An operation to replace the testicle in the scrotum is only advisable *before* the occurrence of attacks of inflammation. After attacks of inflammation have occurred, the secreting structure of the testicle is destroyed, and the organ is rendered useless and only liable to disease. On this account *castration* is indicated, and at the same time the inguinal canal may be examined, and, if hernia is also present, it may be radically cured and the canal closed.

MALIGNANT DISEASE OF THE TESTICLE.

It is difficult to draw a distinction between benign and malignant growths of the testicle, because histologically the tumors are nearly always mixed formations composed of fibrous, myxomatous, sarcomatous, and cartilaginous elements associated together, and tumors of the testicle which are apparently innocent are often followed by secondary deposits in the adjacent lymphatic glands and other organs.

VARIETIES AND CLASSIFICATION.

Sarcoma may be composed of spindle- or round- cells, or may, in its early stages, appear as numerous small cysts, filled with clear or dark fluid, scattered through the substance of the gland.

Carcinoma is usually of the soft, or encephaloid, variety.

Lymphadenoma, chondroma, fibroma, myxoma, and osteoma are also occasionally met with.

The clinical history of sarcoma and carcinoma, which are by far the most common forms, may be considered together.

The *age* at which the disease usually appears is from fifteen to forty-five years, but sarcoma is occasionally found in very young children.

The disease begins in the glandular epithelium of the tubes or in the connective tissue between the tubes, and increases in size, involving the whole body of the testicle.

The tumor formed is smooth and uniform, until the tunica albuginea breaks down, and after this occurs the growth feels irregular or nodular, with areas which are soft and fluctuating. The tumor increases more rapidly in size after rupture of the tunica albuginea and often becomes enormous. The skin of the scrotum sloughs and allows parts of the testicle and granulations to protrude through the opening, forming *fungus testis.*

The spermatic cord enlarges from the infiltration of its tissues by the new growth, and the adjacent lymphatic glands become infected and enlarged.

The veins of the scrotum swell, and the lower extremities become œdematous from the pressure of the pelvic and lumbar glands upon the iliac veins.

The general health fails, the patient becomes cachectic and emaciated, and death results in one or two years after the first appearance of the growth.

PROGNOSIS AND TREATMENT.

The great majority of tumors of the testicle are either malignant, tubercular, or syphilitic, and it is always desirable to try the effect of inunctions of mercury and large doses of iodide of potash, for ten days, if there is any suspicion of syphilis.

If there is no improvement at the end of that time, *castration* should be at once performed.

If this is done early enough, the disease may be permanently cured, but unfortunately it is not uncommon for the lymphatic glands in the pelvis to be involved, and a recurrence of the disease often takes place within a year after the operation.

TUBERCULOSIS OF THE TESTICLE.

The testicle is frequently the seat of tuberculosis, which always begins in the epididymis and may subsequently involve the body of the testicle.

The epididymis may be affected (*a*) primarily, which is most frequent; (*b*) secondarily from a tubercular deposit in one of the other genito-urinary organs; or (*c*) in consequence of a general tuberculosis.

CHANNELS THROUGH WHICH TUBERCLE BACILLI ARE CONVEYED TO THE EPIDIDYMIS.

When the epididymis is affected primarily, the bacilli are introduced into the general blood-circulation and carried directly to the epididymis by the spermatic artery.

When the infection in the epididymis is secondary, it is frequently derived from the seminal vesicles. These are often affected by tuberculosis, as the result of tubercle bacilli which were introduced into the urethra during coitus.

After the tubercular process is established in the vesicles the bacilli are carried along the vas deferens and lodge in the epididymis.

If the tuberculosis in the epididymis is derived from the bladder, prostate, or other adjacent organs, the infection is usually carried by means of the lymphatics.

There are certain *predisposing causes* to tubercular infection, such as hereditary tendency to consumption and such local causes as the prolonged congestion from erotic excitement, an attack of gonorrhœa, or slight traumatism. These causes all probably operate in the same way, and act by lowering the resistance of the tissues and permitting the tubercle bacilli to take effect.

The time of life at which the testicle is most liable to be attacked is during its period of functional activity, from the age of puberty until past the fiftieth year.

COURSE.

One or two small nodules form in the head of the epididymis. Occasionally they remain latent for years or may become encapsulated and converted into fibrous tissue. As a rule, however, the nodules grow and coalesce until the whole epididymis is so much enlarged that it surrounds the testicle. After a time, the tubercular mass softens, becomes cheesy, and breaks down.

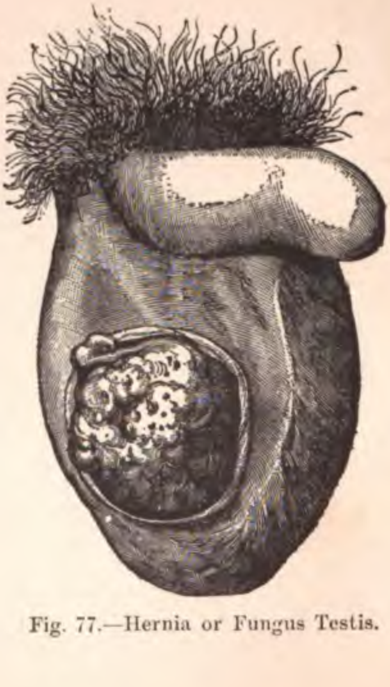

Fig. 77.—Hernia or Fungus Testis.

The skin of the scrotum lying over the nodules is attached to the testicle, glued fast by the inflammatory adhesions, and the pus is discharged through an opening in it from the tubercular abscess, leaving a fistula.

The disease seldom limits itself to the epididymis, but, if let alone, spreads to the testicle. This occurs in three-fourths of the cases, as shown by autopsy.

After the abscess in the epididymis or testicle has opened, a considerable amount of attached skin, lying over the nodule, may slough away, leaving an opening in the scrotum through which a mass of new granulation tissue, growing from the testicle or tunica albuginea, may protrude, forming *hernia testis*, or *fungus testis.*

In the earlier stages of the disease, before abscess-formation, the *tunica vaginalis* is affected by the inflammation, and, if an excess of fluid is secreted by its walls, hydrocele may be present.

On the other hand, adhesive inflammation may take place, and the sac of the tunica vaginalis become obliterated.

Occasionally purulent collections containing tubercle bacilli are found in small cavities, circumscribed by the adhesions.

The *vas deferens* is always affected in time, and shows small localized nodules in its continuity, which are most liable to be located at its extremities,—*i.e.*, near the seminal vesicle and the epididymis,—the intermediate portion being free.

More rarely the cord is uniformly thickened, with a general diffuse tubercular infiltration.

The other testicle in time becomes affected, and the disease runs its usual course.

Although tuberculosis of the testicle usually runs a very slow and insidious course, the nodules developing gradually until the formation of pus, rare cases are occasionally met with in which the disease runs a very acute course, called by Réclus **galloping consumption of the testicle.**

The nodules which had existed quietly for a time from some cause take on a very rapid growth, and caseation and abscess-formation occur in about three weeks. In this form the testicle itself is always attacked, and it is usually accompanied by a purulent urethral discharge containing tubercle bacilli. The discharge may originate spontaneously or it may begin as a gonorrhœa from infection with gonococci during coitus.

SYMPTOMS AND DIAGNOSIS.

Tubercular nodules may exist in the epididymis, and remain latent for months, without causing any discomfort, and, if discovered, they are usually found accidentally.

Discomfort does not occur until inflammation begins, with its pain, swelling, and subsequent abscess-formation.

In the early stages examination shows one or more small nodules of a peculiar stony hardness to the touch located in the head of the epididymis and along the cord.

Later in the disease, after the nodules have become cheesy or broken down, the skin is found to be adherent over a circumscribed tumor, with hard walls and a central softening, which may yield fluctuation if pus is present.

Although the nodule may be actually located in the epididymis, the enlargement of this part of the organ is so great that it may surround the body of the testicle, giving rise to an appearance as though the nodule were in the testicle itself.

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Suspicions as to the tubercular nature of a growth should always be aroused by the history of an epididymitis coming on without any apparent cause or after a slight injury, and, if hard nodules are found in the seminal vesicles or prostate, the diagnosis of tuberculosis is sufficiently established, and may be confirmed by finding tubercle bacilli in the contents of the cheesy nodules.

Under treatment, the severe inflammatory symptoms of epididymitis quickly subside, and are usually followed by a general softening of the tumor and formation of abscess, differing in this way from a simple epididymitis, which, after it is over, leaves a hard and thickened epididymis.

PROGNOSIS

It is a very rare occurrence for tuberculosis of the testicle to become permanently cured without operation, even under the most favorable climatic influences.

When a cure does occur, it is through a process of encapsulation and fibroid degeneration, but it often happens that the process of encapsulation only closes up the infective material for a time, and under favoring conditions the deposit again becomes active and continues its usual course of caseation, abscess-formation, and infection of remote organs.

Tubercular nodules, however, may remain latent for many years before abscess forms, or until a slight traumatism or attack of gonorrhœa stirs them into activity.

After suppuration the disease runs a rapid course, and leads to a fatal termination either by inducing tuberculosis in some other organ or by the exhaustion and fever incident to the occurrence of suppurating fistulæ.

TREATMENT.

Palliative measures are, unfortunately, only applicable to people of means, who are able to lead an out-of-door life or take a long sea-voyage, and who can have constant medical supervision. Such measures may retard the caseation of the nodules if begun in the earliest stage while the deposits are small and hard.

As soon as the deposits begin to soften and become cheesy, surgical measures should at once be resorted to, as waiting for resolution, which never occurs, is only a waste of valuable time, and allows the extension of the disease to remote organs.

In the case of hospital patients, who are poorly nourished and badly housed, and who cannot have suitable climatic surroundings, the nodules should be removed at once.

OPERATIVE TREATMENT.

Erasion, or curetting, is the operation which is applicable to the cases where one or two small nodules exist in the epididymis. The softened area should be opened and the contents well scraped out with a sharp spoon, iodoform rubbed in, and the cavity packed and allowed to heal by granulation.

Castration is the operation best adapted to the advanced cases. The indications for its use have been summarized by Jacobson as follows:—

(*a*) When erasion has failed in lesions of the epididymis.

(*b*) When discharging fistulæ are present or are numerous.

(*c*) When, after erasion, persistent swelling of the testicle accompanied with night-sweats and loss of flesh is present.

(*d*) When fungus testis exists or when the body of the testicle is involved.

(*e*) In the presence of purulent hydrocele.

Castration is used in two different classes of cases:—

Class A.—In *primary* tuberculosis, when the disease is limited to one testicle and has not extended too high along the cord, and when the bladder, prostate, and vesicles are not affected. In such a case a reasonable hope may be entertained that the disease may be permanently eradicated from the body. If the seminal vesicles are affected the indication for castration is not so clear, although, if the deposits are small and of recent date and the patient's general condition favors rapid healing, removing the testicle with its diseased nodules may retard the development of the tubercular foci located elsewhere.

Class B.—In cases where other organs of the body are tubercular and a cure is impossible, hygienic measures alone are the only treatment applicable. An exception should be made to this rule when the testicle is disorganized and the scrotum riddled with sinuses discharging pus. Here castration is indicated to relieve the patient from the drain of the exhausting discharges and from one source of his discomfort.

In the operation of castration the infiltrated skin and cellular tissue should be removed. The spermatic cord should be divided as high up as possible, if necessary laying open the inguinal canal and removing the cord as far as the internal ring.

The cord should be tied with a double ligature through it, as a single ligature is liable to slip off and cause fatal hæmorrhage.

SYPHILIS OF THE TESTICLE.

The testicle is attacked by syphilis in the late secondary and tertiary periods, which presents itself in **two forms**:—

(a) Interstitial or diffuse form consists in an infiltration of the connective tissue between the tubules, which becomes converted into a hard, fibrous induration, which compresses and destroys the tubules, and an atrophy of the entire organ results.

(b) Circumscribed or gummatous form is a deposit of gummatous nodules varying in size from a pin-head to a hen's egg. After they have enlarged to a considerable size the mechanical compression of the cortex causes a cheesy degeneration of the substance and a contraction of the nodule, or the centre becomes softened and is discharged through an ulcerated opening in the skin of the scrotum.

The epididymis may be involved secondarily in both forms, and hydrocele usually occurs from an effusion of fluid into the sac of the tunica vaginalis.

SYMPTOMS AND COURSE.

The body of the testicle enlarges slowly and insidiously, without causing any pain and it often becomes as large as an orange.

In *shape* its outline is regular, although the protuberance of a circumscribed gumma may sometimes be felt. Its consistence is dense, and it feels heavy. The spermatic cord, as a rule, is not thickened.

The scrotum is not affected until after the gumma breaks down, when it becomes adherent, inflames, and ulcerates, and *fungus testis* forms.

The disease is seldom bilateral at the beginning, but the other testicle may be attacked later.

Sterility only results from advanced disease in both organs, as a part of the secreting substance of the gland is spared.

DIAGNOSIS.

Syphilitic testicle is liable to be mistaken for tuberculosis, neoplasms, gonorrhœal epididymitis, or hæmatocele.

The distinguishing points in syphilis are the regular outline and smooth, hard surface, and the fact that the cord is not enlarged, and in addition the history of a past attack of syphilis.

The diagnosis may be confirmed by the effects of antisyphilitic treatment, and this should be tried in every case of tumor of the testicle before proceeding to operation, if there is the slightest question of a previous syphilitic infection.

PROGNOSIS.

Under appropriate treatment syphilitic infiltration is absorbed, and it is surprising to note how quickly large swellings disappear, and the function of the testicle is restored.

In untreated persons—particularly in tubercular, alcoholic, and weakly individuals—the gummata break down and discharge and hernia testis follows, but even neglected cases, which present ulceration of the scrotum and large fungus testis, generally heal in from four to six weeks under antisyphilitic treatment.

TREATMENT.

The treatment consists in a general course of mercurial inunctions and the internal administration of iodide of potash in increasing doses, running it up to $^1/_2$ ounce per day, if necessary, to cause absorption of the newly-formed tissue.

HYDROCELE, HAEMATOCELE, AND VARICOCELE.

CHAPTER XVIII.

HYDROCELE.

BEFORE the testicle descends from the abdominal cavity in the fœtus it is preceded by a process of peritoneum, which makes its way through the inguinal canal and forms a pouch in the scrotum called the *tunica vaginalis testis*. After the testicle has descended it lies *behind* the pouch, and is adherent to it.

Under ordinary conditions the opening in the pouch which formerly communicated with the abdominal cavity is closed. If it remain open, *congenital hydrocele* is said to exist. If the opening closes, the testicle is provided with a shut sac, lying in front of it and partly surrounding it, which serves as a protection against injuries, and allows of a certain freedom of motion.

ACUTE HYDROCELE.

ETIOLOGY.

Acute hydrocele is usually the result of a contusion of the testicle or a punctured wound of the sac of the tunica vaginalis. It may also occur from an extension of inflammation from the epididymis or testicle, occurring in the course of gonorrhœa or other infectious disease.

PATHOLOGY.

Its pathology consists in an accumulation of serous fluid, which is occasionally stained with blood in the sac, and a deposit of lymph upon its walls.

SYMPTOMS.

The symptoms consist in œdema and redness of the scrotum, accompanied by an elastic painful swelling, which is tender on pressure over the testicle.

If much fibrin is deposited, crepitation is sometimes observed. Acute hydrocele *terminates* either in (*a*) recovery in two to three weeks, with the formation of adhesions within the sac and a thickening of its walls; (*b*) in suppuration; or (*c*) it may become chronic.

TREATMENT.

The treatment consists in rest, with suspension of the scrotum and the local use of an ice-bag or hot application. After the acute symptoms have subsided the patient can walk about, wearing a suspensory bandage. If much fluid is present in the sac and tension is extreme, aspiration is required.

ACUTE PURULENT HYDROCELE.

It occasionally happens that a fibroserous hydrocele becomes purulent instead of resolving, or suppuration may occur early as a result of an infected puncture of the sac, or an extension of a suppurative process from the testicle or epididymis.

In such a case the contents of the sac, instead of being clear serum, is composed of pus. Such a condition is apt to result in involvement of the peritoneum or a general septic infection, unless the pus is evacuated by a free incision and drainage.

CHRONIC HYDROCELE.

Chronic hydrocele is generally confined to one side, and ordinarily occurs between the twentieth and fortieth years, although children are occasionally born with it. It generally begins insidiously, although it may follow an acute attack.

It is supposed to be a mere passive process of transudation de-

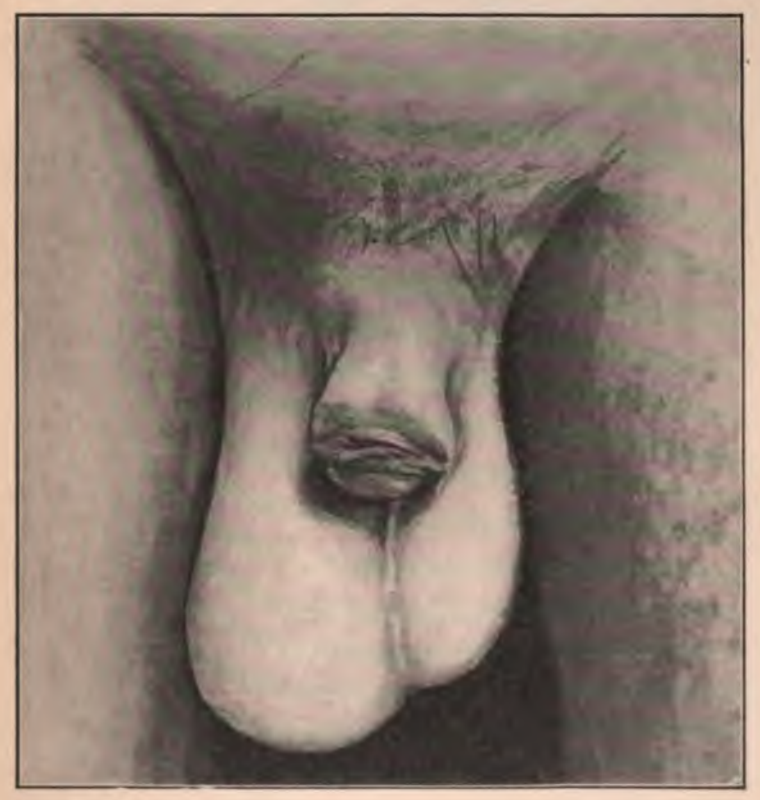

Fig. 78.—Hydrocele. (Author's Case, from Kings County Hospital.)

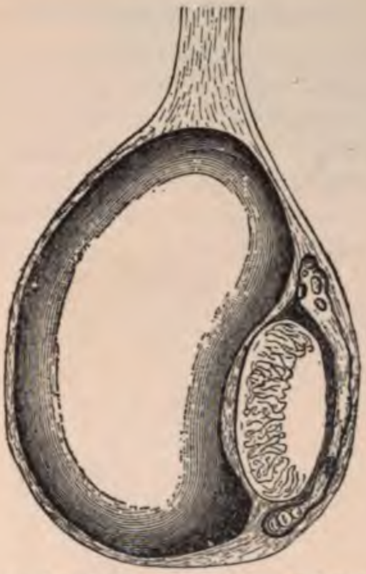

Fig. 79.—Vertical Section of Simple Hydrocele.

pendent upon the state of the blood-vessels and circulation, when it occurs as a primary disease.

PATHOLOGY.

The quantity of fluid which the sac contains is variable, from a few ounces to one, two, or even three quarts. Its color is usually clear and watery, but it may be greenish or bloody. If it contain a large number of desquamated epithelial cells and leucocytes, it appears turbid, and blood gives it a reddish or brown color.

In rare cases the fluid is white, and resembles milk, from an admixture with lymph (hydrocele chylosa), and in the tropics, and in cases of true elephantiasis, filiaria are found in the milk-like contents of the sac.

In long-standing cases of chronic hydrocele the tunica vaginalis is thickened, and may be calcified in portions, and the testicle and epididymis are hard and atrophied.

Sometimes adhesions form, and the sac is converted into a number of distinct compartments. In other cases small fibrous or fibrocystic bodies are attached to the wall or lie loosely within the sac.

SYMPTOMS AND DIAGNOSIS.

Hydrocele causes no symptoms except those which arise from the increase in size and weight of the scrotal enlargement.

On palpation, the tumor is found to be pear-shaped and elastic to the touch, dull on percussion, without impulse on coughing, and it cannot be reduced and returned into the abdomen.

Attention to these points will usually differentiate a hydrocele from a hernia, hæmatocele, neoplasm of the testicle, or a hydrocele of the cord.

An additional point in diagnosis is the *translucency* of the hydrocele when it is viewed through a tube with a candle placed on the other side of the scrotum.

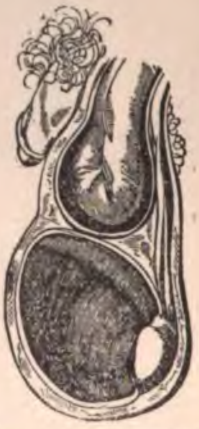

Fig. 80.—Hydrocele Complicated by Hernia.

This sign is not infallible, however, as the thickened walls of the sac or turbidity of its contents from pus or blood prevent the light from being transmitted.

As a last resource in diagnosis a suspected hydrocele may be aspirated with a fine needle, or the patient may be prepared for operation and the contents of the scrotum exposed by an incision.

TREATMENT.

The spontaneous healing of a hydrocele in an adult is such a rare occurrence that operation is always called for.

Puncture with a trocar may be regarded as palliative only, for the sac always fills up again with fluid in a short time.

Technique.—The scrotum is grasped in the hand and made tense, and after locating the position of the testicle, which is usually a little below and lying behind the sac, the trocar, with its point directed obliquely upward and inward, is thrust into the swelling, and the fluid is withdrawn.

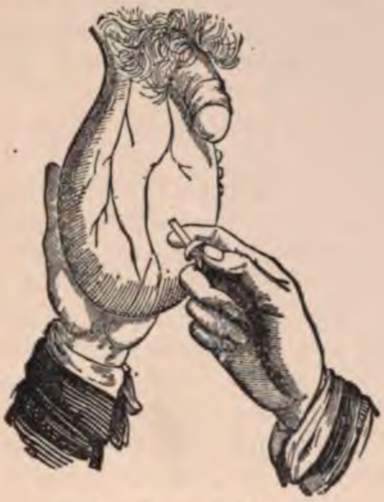

Fig. 81.—Tapping a Hydrocele.

Radical Treatment by Injection.—This is successful in many cases of hydrocele of moderate size and where the walls of the sac are not thickened, although it is more liable to be followed by a relapse than after incision.

The advantages of injection are that no anæsthetic is required and the patient is only confined to the house three or four days.

Technique.—A hypodermic syringe is filled with 30 drops of pure carbolic acid, and the needle is introduced into the cavity of the sac. The hydrocele is then tapped with a trocar in the ordinary way, and the fluid drawn off entirely. It is necessary that the sac should be completely emptied, for, if fluid is left in, the carbolic acid is diluted, so that it does not produce the necessary amount of irritation, and if diluted it may be absorbed and cause poisoning.

After the fluid is drawn off the carbolic acid should be injected, through the hypodermic needle, which has remained *in situ*, and the carbolic acid is not withdrawn, but left in the sac. Inflammatory reaction is excited, but the exudate is gradually absorbed, and the sac becomes obliterated by the formation of adhesions between its visceral and parietal walls.

Incision of the sac is preferred to the treatment by injection in the following cases (Morris):—

I. When the sac is very thick, opaque, cartilaginous, or calcified.

II. If doubt exists as to whether the hydrocele is congenital or is a hydrocele of a hernial sac with a small opening into the peritoneum.

III. When a hernia complicates hydrocele and a radical cure of both is desired.

IV. When a loose or pedunculated fibrous body is present in the tunica vaginalis.

V. When organic disease of the testicle is suspected.

VI. When on account of ill health or lessened resistance the risk of inflammation after injection is especially to be dreaded.

There are two methods[1] of performing the operation of incision:

(*a*) *Volkmann's Operation of Simple Incision.*—In this procedure the sac is opened by a longitudinal incision through the scrotum, and after the fluid is evacuated the edges of the walls of the sac are stitched to the edges of the wound in the skin, to prevent leakage into the cellular tissue of the scrotum. The cavity of the sac is packed and allowed to heal by granulation, and in this way the sac becomes obliterated. The patient is able to get out of bed in a week, and the wound is healed by about the third week.

(*b*) *Von Bergmann's Operation of Incision and Excision of the Tunica Vaginalis.*—Tillmanns considers this the best radical operation. The sac is laid bare by a longitudinal incision, and by blunt dissection is freed from the cellular tissue. The redundant portion of the sac is then cut away with scissors from the testicle, but leaving enough of the wall of the sac to cover the testicle itself. The external wound is closed with sutures, and a dressing applied which will exert compression. The wound is cicatrized in from eight to twelve days. Relapses are more certainly prevented through excision than by other methods, and the wound heals in a very short time.

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[1] An excellent operative procedure recently suggested by Doyen for thin-walled hydroceles consists in incising the sac and everting the testicle so that it lies outside the sac. The wound in the sac is then sutured to prevent the return of the hydrocele, and the incision in the scrotum is closed without drainage.

HYDROCELE OF THE SPERMATIC CORD.

(a) The cystic form is found as one or more small cysts, which form in the sheath of the cord, along its course between the testicle and the internal ring. The cysts are caused by an effusion of serous fluid into some part of the processus vaginalis, which was not obliterated after the descent of the testicle.

The cysts usually occur between the testicle and external ring, and may extend so far down into the scrotum as to displace the testicle to one side; in a few cases the cyst lies *within* the inguinal canal.

Occasionally the cyst forming a hydrocele of the cord is not closed at either end, but communicates with the tunica vaginalis and also the peritoneal cavity (communicating hydrocele of the cord), and it is a frequent occurrence for the cyst to communicate with the sac of the tunica vaginalis testis. The cysts are shaped like an egg, and range in size from a pea to a hen's egg.

(b) The diffuse form of hydrocele of the cord is of extremely rare occurrence, and consists in an œdematous infiltration of the entire sheath of the cord, ceasing abruptly at the testicle below. The chief importance of hydrocele of the cord is from a diagnostic standpoint: in differentiating it from cryptorchism or hernia.

TREATMENT.

The use of injections of carbolic acid is attended with some danger, as the cyst may communicate with the peritoneal cavity and the carbolic acid may flow back into the abdominal cavity.

Operation is usually called for, and consists in division of the common sheath of the cord, in a longitudinal direction, and exsection of as much of the sac as can be separated from the cord. If the sac is found to be open, communicating with the peritoneal cavity, it is necessary to close the inguinal canal by suturing the upper edge to Poupart's ligament, as in Bassini's operation for hernia. If this were not done, the omentum and gut would subsequently descend through the patulous inguinal canal, and cause hernia.

HÆMATOCELE.

Hæmatocele is the name given to the tumor which forms when a hæmorrhage occurs (*a*) into the sac of the tunica vaginalis (vaginal hæmatocele), or (*b*) into the scrotal tissues around the testicle (extravaginal hæmatocele), or (*c*) with the sheath of the spermatic cord (hæmatocele of the cord).

ETIOLOGY.

A *predisposing cause* in the shape of disease of the walls of the tunica vaginalis or of the testicle is very apt to be present.

The *exciting cause* of the hæmorrhage is always traumatism, which may be slight, such as coughing, sneezing, or straining at stool,—or it may be severe and the result of a blow or kick upon the scrotum or the accidental puncture of the testis with a trocar in tapping a hydrocele.

SYMPTOMS AND COURSE.

Swelling of the scrotum takes place very quickly after the injury, and a tumor forms, which is a hard, smooth, globular swelling surrounding the testicle. After a few days inflammatory thickening of the tissues occurs, and the hæmatocele is liable to be mistaken for a neoplasm of the testicle.

The blood-clot may remain for years without being absorbed, in which case the walls of the tunica vaginalis become thick and dense, and the testicle undergoes atrophy. On the other hand, the clot may become infected, and suppuration, ending in abscess, occurs.

TREATMENT.

In recent cases a moderate effusion of blood may be absorbed with the assistance of rest in bed, elevation of the scrotum, and 25- to 50-per-cent. ointment of ichthyol; but spontaneous absorption is of seldom occurrence, and operation is usually necessary.

The operative treatment consists in laying open the sac by a free incision and evacuating the blood-clot. The sac of the tunica vaginalis may afterward be treated as a hydrocele, and either excised or its cavity packed and allowed to granulate.

HÆMATOCELE OF THE SPERMATIC CORD.

This is a rare affection, and may occur from direct violence or from the strain of lifting a heavy weight, even though the cord is perfectly healthy.

A fusiform swelling rapidly develops along the cord, which is easily mistaken for hernia. After a few hours the swelling becomes hard and tense, with ecchymoses into the surrounding tissues, and the diagnosis is made clear.

The treatment is conducted on the same lines as for hæmatocele of the tunica vaginalis.

VARICOCELE.

Varicocele is an abnormal dilatation of the veins of the spermatic cord, and is analogous to the varicosities which occur in the veins of the lower extremities.

A slight varicocele often disappears spontaneously after marriage, when sexual intercourse is duly regulated and also in old age.

ETIOLOGY.

The causes of varicocele are, in a general way, those of varicosities elsewhere; prolonged standing, ungratified sexual excitement continued for some time, and constipation, all tend to cause passive congestion and disturbance of the circulation, with increase of hydrostatic pressure in the veins of the cord.

The spermatic veins are more liable to enlarge than others, because their valves are insufficient to uphold the long column of blood, which also derive but little external support from the loose cellular tissue of the scrotum in which they lie.

Billroth believes that there is an inherited predisposition to the formation of varicosities, which is first manifested in the spermatic veins, and later in those of the rectum and legs.

Varicocele occurs most frequently on the left side, because, while the right spermatic vein enters the vena cava at a sharp angle, the left spermatic vein, after passing underneath the sigmoid flexure, empties at a *right angle* into the left renal vein. The pressure exerted by the colon and the right-angled insertion of the vein tend to impede the current of blood, and cause an increase in the hydrostatic pressure, which is greater on the left side than on the right.

SYMPTOMS.

In robust and vigorous men varicocele of moderate size causes but little discomfort, at most only a sense of weight and dragging in the spermatic cord, after long standing, walking, riding, or any sudden exertion. These things all exaggerate the swelling of the veins, and the discomfort from them is always increased toward evening.

In young men who are weak or anæmic or who have previously masturbated excessively, a feeling of fullness and burning in the scrotum and cord, accompanied by pains radiating into the abdomen and occasionally marked neuralgia of the testicle, is often met with. Such individuals are frequently sexual hypochondriacs, and suffer from mental depression and the fear of impaired virility, or even impotence, arising from the varicocele. They should be taught to regard the varicocele, if moderate in size, with indifference, as it has a natural tendency to subside as age advances and particularly after the regulated coitus of marriage is instituted.

It is only in cases of very pronounced varicocele, where the circulation is materially impaired, that serious atrophy of the testicle occurs, although in every case of varicosities of the cord the circulation in the testicle is somewhat interfered with, and it is softer and smaller than normal.

The spermatic vein may become the seat of disease, and in rare cases thrombosis, phlebitis, gangrene, etc., may occur.

DIAGNOSIS.

The diagnosis of varicocele is usually easy, and the veins in the scrotum feel like a bunch of angle-worms. In very marked cases the enlarged blue veins can be seen shining through the skin of the scrotum. In cases of moderate severity the testicle is slightly flabby and the skin of the scrotum relaxed.

If the patient lies down, the swelling disappears, not suddenly, like a hernia, but more gradually, and almost imperceptibly; and, if he stands upright again, pressure with the finger over the

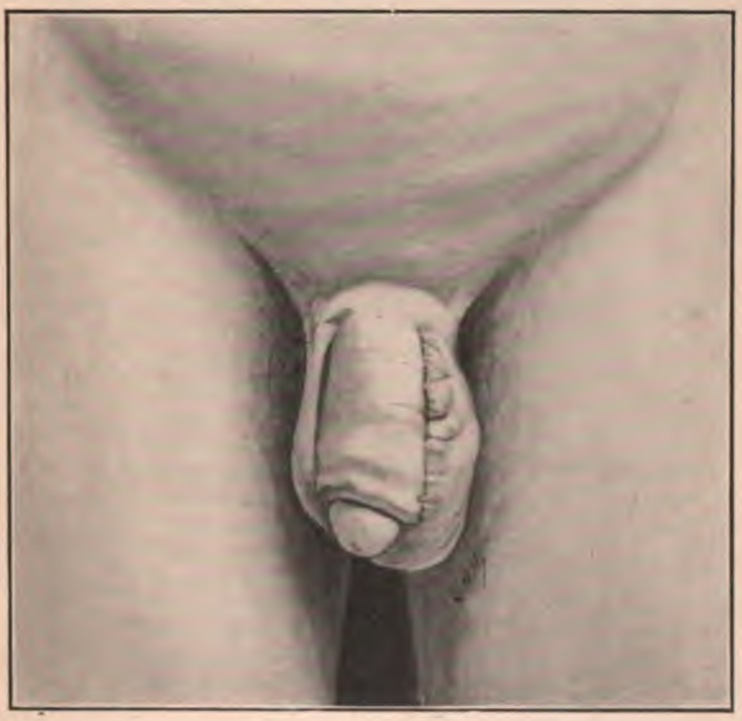

Fig. 82.—Varicocele. (Author's Case, from Kings County Hospital.)

external ring does not prevent the veins from refilling with blood, whereas in hernia the omentum is prevented from descending by pressure over the ring.

TREATMENT.

Palliative treatment is all that is required in varicocele of moderate size and which causes but little discomfort. The scrotum should be supported with a well-fitting suspensory bandage, and, locally, cold douching is of service in giving tone to the muscles. Constipation should be prevented, and the patient should avoid erotic excitement or too frequent coitus.

Operation is required only in marked cases, when the support of a suspensory bandage is not sufficient to remove the annoyance of weight and dragging, after walking or long standing, or in cases where a considerable degree of enlargement of the veins exists. Operation is also called for, in persons desiring to enter the army, navy, or police service, in which any degree of varicocele is regarded as a disability.

The operation of **subcutaneous ligation of the veins** is popular with some surgeons. It has the advantage that the time of convalescence is a little shortened, but its disadvantages are weighty. A vein is very liable to be punctured, and an hæmatocele occurs. The silk ligature remains permanently, becomes imbedded in scar-tissue, and sometimes causes persistent neuralgia, making it necessary to open up the wound and exsect the knot, or the knot may slip and the vein is not occluded. The danger of tying in the spermatic cord exists, but can be guarded against by due care in holding the cord out of the way.

Relapses occur with greater frequency after subcutaneous ligation than after excision.

Excision of a portion of the veins is the operation to be preferred, and the patient is only kept in bed for a week or ten days. By the open operation it is possible to avoid all the dangers attendant upon the subcutaneous ligation.

Technique.—The patient is etherized, and an incision made over the bunch of veins, beginning near the external inguinal ring and extending two inches down over the scrotum. The veins are exposed by dissection and ligated in two places, about an inch apart. The portion of the veins lying between the ligatures is then cut out with scissors, and the cut ends of each portion of the vein are brought together into apposition and held so, by tying the ends of the ligatures together, and in this way the vein is shortened. The wound is then closed by sutures.

The patient is kept in bed for a week, and on a sofa for another week, and after the third week is completed he can begin his active labors, and the same length of time should elapse after the subcutaneous ligation.

After either operation a hard mass remains in the scrotum, composed of coagula in the veins and infiltration around them. This is absorbed and disappears in from two to four months.

Atrophy of the testicle exceptionally follows either operation, even when the cord is not included in the ligature.

CHANCROID AND ITS COMPLICATIONS.

CHAPTER XIX.

CHANCROID.

Synonyms.—Soft chancre, or simple venereal ulcer.

ETIOLOGY.

There are at present two views held in regard to the **etiology** of chancroid: (*a*) It is supposed by some to be due to a particular micro-organism produced in *another* chancroid, which is named, after its discoverer, the **bacillus of Ducrey.** (*b*) The other view, which is more generally held, is that chancroid is merely an active form of *wound-infection,* and that it is caused by the inoculation under the skin of *any* of the pus-producing micro-organisms, and in this and other respects resembles clinically impetigo contagiosa or ecthyma.

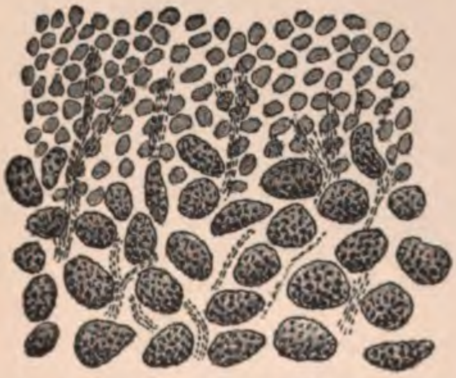

Fig. 83.—Section of Chancroid, showing Ducrey's Bacillus, which has the form of small rods arranged in chains.

MODES OF CONTAGION.

(*a*) *Immediate*: *i.e.*, through direct contact, as in coitus, or by digital examination, etc.

(*b*) *Mediate*, in which contact is not made with the chancroid, but some of the pus is deposited upon an instrument, towel, chamber utensil, water-closet seat, etc., and from this point is brought into contact with another person, who becomes infected.

The pus from a chancroid is acrid and irritating, and has the property of softening and corroding the healthy epidermis; so that an *abraded surface is not essential* for the entrance of the micro-organisms under the skin.

FREQUENCY OF CHANCROID.

Chancroid is more common among the lower classes than among cleanly and well-nourished people, as its development is favored by filthy habits and dirty surroundings, and all the accompaniments of privation and misery.

COURSE.

Chancroid is usually multiple, although it sometimes exists singly. The fact of the sores being multiple is accounted for in the following ways:—

(*a*) A number of points are inoculated with chancroidal pus at the time of contagion.

(*b*) Through *autoinoculation*.

Autoinoculation may be defined as the action of pus formed in one chancroid producing other chancroids in the same individual: *i.e.*, the inoculation of the patient with pus from his own chancroid.

After inoculation, in about twenty-four hours several *pustules* appear, which spread at the margins; the tissues adjacent are involved and break down, and the ulceration extends.

CHARACTERISTICS.

In chancroid there is no period of incubation, and it is generally noticed on the third day after coitus.

The location is usually on the genitals, although it exceptionally occurs on the fingers.

In **shape** the sore is usually irregular, although it may be round or oval.

Number.—It is exceptional for chancroids to exist singly. They

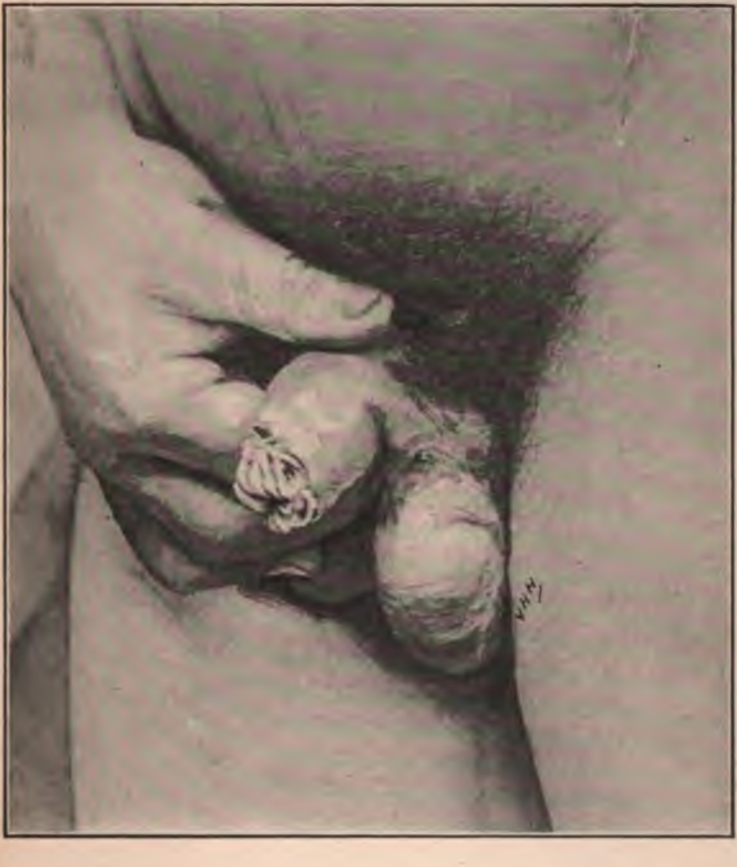

Fig. 84.—Chancroids of the Prepuce. (Author's Case, from Kings County Hospital.)

are usually *multiple*, either from the simultaneous inoculation of several points at first or from subsequent autoinoculation.

Pain is usually present to a considerable extent.

The base of the sore in a typical case is *devoid of induration*, but if an excessive amount of inflammation has taken place—as a result of insufficient and frequent cauterization, prolonged contact with irritating urine, pus, or acrid secretions—an inflammatory or boggy hardness is often present. This does not feel like the induration of a chancre, which is sharply defined and which resembles a piece of cartilage under the skin, but is doughy or boggy in feeling, and shades off gradually into the surrounding tissues.

The floor of the chancroid is rough and uneven, and covered with a dirty-grayish deposit.

The edges of the sore are undermined, and the *discharge* is abundant, purulent, and sometimes bloody.

Duration of the chancroid may be divided into stages:—

I. Progressive stage, during which each sore extends by a breaking down and ulceration of the edges, and fresh sores are continually forming as a result of autoinoculation.

II. Stationary stage. After a time the pus loses its virulence, autoinoculation of fresh surfaces no longer occurs, and the ulcers cease to increase in size, but remain stationary.

III. The reparative stage begins when the sores are covered with healthy granulations and cicatrization is in progress.

The various stages require about six weeks in time for uncomplicated cases, but **relapses from autoinoculation** are very frequent, and delay the healing process.

Microscopic examination of a chancroid shows it to be composed of a small round-celled infiltration which takes place in the skin and subcutaneous tissues, and which leads in time to coagulation-necrosis.

The lymphatics are not involved, but remain open and gaping, ready to convey micro-organisms or toxins to the nearest lymphatic gland, and in this way we can account for the frequent occurrence of bubo.

Until 1852, chancroid was regarded as a syphilitic manifestation; yet the true difference between the two diseases would have been sooner discovered but for the **mixed sore.** It sometimes happens that an individual is syphilitic and has accidentally acquired chancroids. As a result of contact with both poisons, usually during coitus, another person receives a *double infection*: *i.e.*, the virus of syphilis and that of chancroid are both inoculated at the same moment. The chancroid appears in twenty-four hours, but, on account of the longer incubation of syphilis, the chancre is not evident for at least three weeks. After this period has gone by, the base of the chancroid becomes hard and sclerosed and the sore is transformed into a true chancre which is followed by symptoms of constitutional syphilis.

DIAGNOSIS.

It is often difficult to make a differential diagnosis between chancre and chancroid, particularly in the cases where an excessive amount of inflammation has occurred and a condition of boggy inflammatory induration is present. We should always bear in mind the possibility of a mixed sore being present, and it is usually well to allow three or four weeks to elapse before excluding syphilitic infection.

The principal points to consider in making a differential diagnosis are as follow:—

I. The period of incubation: *i.e.*, the time which elapses between coitus and the appearance of the sore.

II. The *absence* of the cartilaginous induration, which characterizes the primary lesion of syphilis.

III. The ragged, punched-out appearance of the sores, which are usually multiple.

IV. The character of the accompanying enlargement of the inguinal lymphatic glands.

Herpes præputialis is sometimes incorrectly diagnosed as chancroid. This mistake ought not to occur, if due care is used in the examination. Herpes appears as a number of small vesicles, which form upon the glans, prepuce, or skin of the penis. The vesicles soon break, and leave small, round, superficial erosions, which rapidly heal under a simple dusting-powder.

TREATMENT.

(a) Abortive. — If the chancroid is seen early enough, the indication for treatment is to *destroy* the chancroidal character of the sore and transform it into a simple non-infected ulcer.

Methods.—Nitrate of silver should never be used for this purpose, as its cauterizing action does not penetrate deeply enough into the substance of the sore.

The best means to this end is the Paquelin cautery. Fuming nitric acid or the acid nitrate of mercury applied to the sore upon a glass rod will answer the same purpose. The ulcerating surfaces should be washed clean and anæsthetized by chloride of ethyl, a drop of carbolic acid, or cocaine solution before cauterizing.

It is an error to cauterize every chancroid as a routine measure, and we can lay it down as a rule *never* to cauterize *unless the chancroid* is *free from complications*, as follows:—

Contra-indications for Cauterization.—(*a*) If the inflammation is already excessive and much *inflammatory œdema* is present, the irritation of cauterizing will increase it.

(*b*) If *inguinal adenitis* is present, the bubo will be made worse by cauterizing the chancroid.

(*c*) In the case of a *healing cicatrizing chancroid* the chancroidal virus has already disappeared, and cauterization is useless.

(*d*) If a *number* of *chancroids* are *present*, and *only* a *few are exposed*, the entire number should be destroyed, or none at all, for if any are left untouched, they will secrete pus, which will infect fresh surfaces.

(*e*) If a chancroid of the meatus or in the urethra is cauterized, the resulting cicatricial contraction after the sore is healed will produce too much deformity of the parts affected.

(b) The methodic treatment is carried out by means of:—

I. Cleanliness.

II. Antisepsis.

III. Rest.

The chancroids should be kept free from the accumulation of discharge by means of frequent washing with solutions of bichloride of mercury, 1 in 5000 or 10,000; or carbolic acid, 2 per cent.

Dry dressings or dusting-powders should only be used under the foreskin and never upon a sore located on the integument. The powder, which is exposed to the air, dries, sticks fast, and tears open the wound when the dressing is changed.

The following antiseptic powders are the most serviceable: Iodoform, salicylic acid packed into the sore, aristol, subgallate of bismuth (dermatol), resorcin, and nosophen.

When the chancroid is located upon the integument, *wet dressings* are called for. A piece of cotton or gauze should be wet with bichloride, carbolic, or Thiersch's solution, covered with a piece of gutta-percha tissue to prevent evaporation, and held in place with a bandage.

COMPLICATIONS OF CHANCROID.

The accompanying inflammation may at times become *excessive* from such *general* causes as debility or some dyscrasia, or *local* causes, such as contact of urine or lack of cleanliness. An excessive inflammation, if untreated, is apt to terminate in *gangrene* and sloughing of the parts.

Subpreputial Chancroids Complicated by Phimosis.—When chancroids are located under a long and tight foreskin, the resultant swelling and œdema prevent its retraction, and render the diagnosis difficult. Artificial inoculation of the patient upon the thigh, with pus from under the foreskin, has been resorted to, to differentiate between chancre and chancroid.

The possibility of the presence of a mixed sore should always be borne in mind in these cases.

TREATMENT.

The preputial sac may be kept clean by the use of antiseptic injections with a flat-billed syringe under the foreskin, using a weak carbolic or sublimate solution every hour or two. An attempt should also be made to retract the foreskin and cauterize the sores, which can be facilitated by prolonged soaking of the penis in hot water.

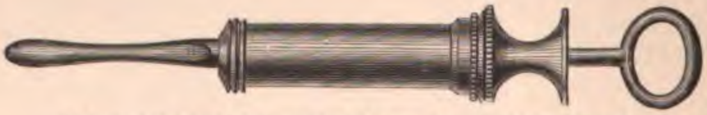

Fig. 85.—Taylor's Flat-Billed Syringe for Washing Out the Balano-preputial Sac.

On account of the danger of paraphimosis, the foreskin should not be left retracted, but drawn back into place.

In case the swelling increases and surgical interference is not resorted to, the dorsum of the prepuce becomes gangrenous and sloughs in part, or the entire foreskin sloughs off (spontaneous circumcision), or the glans penis becomes gangrenous and sloughs, either entirely or partially.

If gangrene is threatening, recourse must be had at once to **operative measures.** The prepuce should be slit up, upon the dorsum, with a curved bistoury, to relieve the tension.

The chancroids are exposed and cauterized, and in addition the entire surface of the fresh cut wound is cauterized, as well, with either the Paquelin cautery or nitric acid.

Circumcision should never be performed in the presence of chancroids on account of the danger of infecting the wound with chancroidal virus, and converting its entire surface into a chancroidal ulcer.

In all cases of subpreputial chancroids, if at all severe, the radical treatment of slitting up the foreskin and cauterizing is to be preferred to temporizing with injections under the foreskin.

When *chancroid* of *the frænum* exists, the artery is liable to be ruptured during erection and hæmorrhage occurs. To prevent this accident, it is proper to tie a double ligature around the frænum, divide the frænum between the ligatures with a pair of scissors, and cauterize the sore.

Paraphimosis is the condition in which a long foreskin is retracted behind the glans, and, from the swelling and œdema which take place in it, is prevented from being drawn back into place. Gangrene and sloughing may result, if the condition is left untreated. The constricting band should be cut upon the dorsum by inserting a curved bistoury under it and cutting outward.

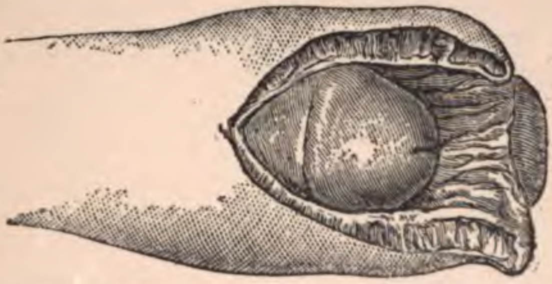

Fig. 86.—Dorsal Incision through Prepuce to expose Chancroids.

PHAGEDÆNA.

This, most formidable of all the complications of chancroid, is rarely encountered at the present day.

It is due to debility of the individual attacked, as a result of some dyscrasia, alcoholism, syphilis, tuberculosis, privation, etc.

Two varieties are noted:—

(a) Serpiginous, in which the ulceration creeps slowly along, advancing at one side. It is a very chronic condition, and may last for months.

(b) Sloughing, in which the parts die *en masse* in a short time.

TREATMENT.

The first indication is to treat the dyscrasia, by means of tonics, of which the potassio-tartrate of iron in 5-grain doses every three hours is highly spoken of, quinine in tonic doses, and opium for its effect on the pain. Easily-digested nutritious food and milk-punch should be administered.

Locally the ulcerating surface should be cauterized, with the Paquelin or nitric acid, and dressed with iodoform. In cases which fail to respond to the ordinary treatment *hot baths* are valuable. The body is immersed for days and weeks at a time in a tub in which the water is kept constantly changing and at the same temperature. Under the use of the hot water the sloughing ceases and the ulcers take on healthy granulation.

BUBO.

The term bubo is applied to the inflammatory enlargement of any lymphatic gland, but especially in the inguinal region.

It accompanies chancroid in from 30 to 50 per cent. of all cases, and is particularly liable to occur in debilitated badly-nourished subjects.

ETIOLOGY.

There are two views held in regard to the causation of bubo:—

(*a*) It is believed that the inflammation of the lymphatic glands is caused by the *micro-organisms* from the chancroid, which are carried to the glands through the lymphatic vessels and deposited in them.

(*b*) It is held by others that the micro-organisms themselves are not carried to the glands, but only certain chemical substances (toxins), which are formed in the chancroid as a result of bacterial growth and deposited in the adjacent lymphatic glands.

COURSE.

One gland alone may be affected, but, as a rule, the whole chain on one side is involved, and it is not infrequent for several glands on both sides to be attacked.

Exceptionally the involvement may disappear by resolution, but in the great majority of cases the glands suppurate and break down.

The process of softening of the chain of glands, and their breaking down and suppuration, and the slow evacuation of the pus through a small opening, is a very protracted one, and may last for months unless the diseased glands are completely extirpated by surgical measures.

The accompanying table indicates the chief points of difference between the glandular enlargement of syphilis and that of chancroid:—

DIFFERENTIAL DIAGNOSIS OF BUBO AND SYPHILITIC ADENOPATHY.

CHANCROID.	SYPHILIS.
One side affected, as a rule.	Both sides affected.
Shape:	*Shape*:
Irregular and boggy.	Regular, smooth, and hard.
Size:	*Size*:
Large.	Small.
Number:	*Number*:
May be single.	Always multiple and arranged in a chain.
General Characteristics:	*General Characteristics*:
Considerable amount of inflammation, causing adherence to overlying skin. Generally suppurate.	No inflammation. Not adherent to skin, but freely movable. Do not suppurate.

TREATMENT.

The indications are:—

I. To prevent suppuration.

II. After suppuration has taken place to evacuate the pus and extirpate the diseased glandular structures.

To prevent suppuration, the most important measure is *rest in bed*, supplemented by the pressure of a sand-bag over the inflamed gland.

Cold, in the form of an ice-bag or evaporating lotion, is sometimes of use. Tincture of iodine is often prescribed, but is of little use in assisting resolution; if ordered at all, it should not be painted *over* the inflamed gland, but in a ring around it.

Ichthyol ointment, 50 per cent., is frequently used, but is of less value here than in other conditions.

The injection of antiseptic solutions into the substance of the gland with a hypodermic syringe, using carbolic acid (15 per cent.) or benzoate of mercury (1 per cent.) is a rational measure, and has attained a fair degree of success in preventing suppuration.

The various measures above mentioned, however, rarely succeed in preventing the formation of pus, and on that account it is better not to lose valuable time, in efforts to abort the suppuration, which will most likely prove unavailing in the end, but to have recourse promptly to surgical measures.

Operative Treatment. — (*a*) *Before Suppuration.* — If the case comes to operation before the glands have begun to suppurate, a curved incision should be made through the skin, and the flap turned back, exposing the entire chain of glands, which can be dissected out. If the operation is done before the formation of pus, the wound may be entirely closed by sutures, and primary union usually occurs.

(*b*) *After Suppuration.*—When the glands have begun to suppurate it is no longer possible to close the wound entirely by suture, on account of the certainty of infection, and, instead of the patient being able to walk about in a week with the wound closed by primary union, he has to wait from four to six weeks for the slow healing by granulation of the open wound.

The indications for treatment after suppuration has occurred are to evacuate the pus, by a free incision, and at the same time remove completely all portions of the glandular structure, by means of careful dissection or the sharp curette. The wound is left open and packed with iodoform gauze, and heals by granulation. An objection to extirpating the glands before they have entirely broken down is that, in occasional rare instances, a permanent œdema—resembling elephantiasis—of the penis, scrotum, and inguinal region follows, in consequence of the obliteration of the lymphatic vessels in the process of wound-healing.[1] For this reason Krulle advises the applications of hot fomentations till the gland is entirely broken down, when the pus is evacuated through a small incision. Every second day the pus should be squeezed out and the cavity of the wound washed with 1-per-cent. nitrate-of-silver solution. Under this treatment the patient can walk about, and avoids the necessity of lying in bed. This plan may work successfully when the glands break down rapidly, but in many instances the suppuration goes on very slowly, and it is better to make a free incision, evacuate the pus, and dissect or curette out the partially broken down remains of the glands.

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[1] Out of over a hundred cases of bubo treated by dissecting out the glands, the author has only seen this complication occur once.

SYPHILIS AND ITS LESIONS.

CHAPTER XX.

CHANCRE.

Synonyms.—Initial lesion of syphilis; initial sclerosis; hard chancre.

Definition.—Chancre may be defined as "the first manifestation of the syphilitic poison at the seat of its entrance into the body."

The poison of syphilis, which is inoculated into an individual and causes the chancre, is derived from the secretions and broken-down *detritus* formed in:—

(*a*) A chancre in another person.

(*b*) Mucous patches.

(*c*) Condylomata.

(*d*) Blood.

(*e*) Lymph.

(*f*) It was formerly thought that the *physiological secretions* did not contain the syphilitic virus, but recent investigations have shown that in exceptional cases they do contain the poison.

COURSE.

When the poison of syphilis is first inoculated under the skin, it is too small in quantity to produce any symptoms. But the poison increases in amount, and, after three or four weeks have passed, the quantity is so great at the point of inoculation that the tissues react, and the chancre appears.

At this time the syphilitic virus is not distributed all through the body, but is localized to the tissues around the chancre and in the nearest lymphatic glands. Later on in the disease the poison increases to an enormous extent, makes its way through the lymphatic system into the circulation, and the blood and lymph become surcharged with it.

The pus from a chancre, unlike that formed in a chancroid, has not the property of destroying the epidermis, and in order to produce a chancre it is necessary that the poison from a syphilitic lesion be introduced through an *abraded surface.*

This fact explains the cases in which a physician attends a syphilitic woman in confinement or a man has coitus with a woman who is affected with condylomata or a chancre, and, if an abrasion did not exist at the time of contact, inoculation does not occur.

Every case of syphilis contracted after birth must have a chancre for its point of departure.

There is, however, one *exception* to this rule. A healthy woman who has connection with a syphilitic man may escape inoculation with syphilis, but become pregnant. The child which is generated by a syphilitic father is infected with syphilis, and as it develops *in utero* the syphilitic virus passes from the child to the mother through the placental circulation, and in turn the mother becomes infected with syphilis from her own child. In this case chancre does not form either in the mother or child.

The form of infection of the mother just described, from carrying her own child *in utero*, is called "*Choc en retour*," or "syphilis by conception."

TRANSMISSION OF CONTAGION.

The methods by which the contagion is transmitted may be classified as:—

(*a*) Direct.
(*b*) Indirect, or mediate.
(*c*) Inheritance.
(*d*) *Choc en retour*, or syphilis by conception.

By *direct contagion* we understand those methods in which the syphilis is inoculated by *personal contact*, such as coitus, kissing, surgical operations, a syphilitic child infecting its wet-nurse, or a healthy child acquiring syphilis by nursing from a syphilitic wet-nurse.

In *indirect*, or *mediate, contagion* the disease is conveyed through the medium of some article which has been infected with the virus of syphilis, such as a spoon, pipe, cup, or cigar used by a person with mucous patches in the mouth; an instrument used for tattooing, dental or surgical operations, which had been used on a syphilitic individual and not cleaned afterward, or by means of underclothing or a bathing-suit which was stained with secretions from syphilitic lesions.

Vaccination chancre in former years was not uncommon, and was caused by vaccinating with an instrument which had previously been used to vaccinate a syphilitic individual, and which was not afterward cleansed, but was used still contaminated with the syphilitic virus.

Chancres were also produced by vaccinating, with dried lymph-crusts, which had been taken from vaccine-vesicles produced in an individual who was also affected with syphilis at the same time.

At the present day animal vaccine-lymph, taken from the calf, is used exclusively, and, as cattle are immune from syphilis, a chancre as the result of vaccination never occurs.

The **location of the chancre** depends, of course, upon the point at which the syphilitic virus is inoculated. The chancre appears most frequently on the genitals, but may be on the lips, tongue, breast, or fingers. It begins as a papule or small tumor, which increases in size; the surface becomes eroded, or ulcerated, and furnishes a secretion which is not autoinoculable. The most characteristic feature of the chancre is **induration of the base,** which is caused by a deposit of small round cells in the tissues underlying the chancre, and also by inflammatory changes in the blood-vessels.

PATHOLOGY.

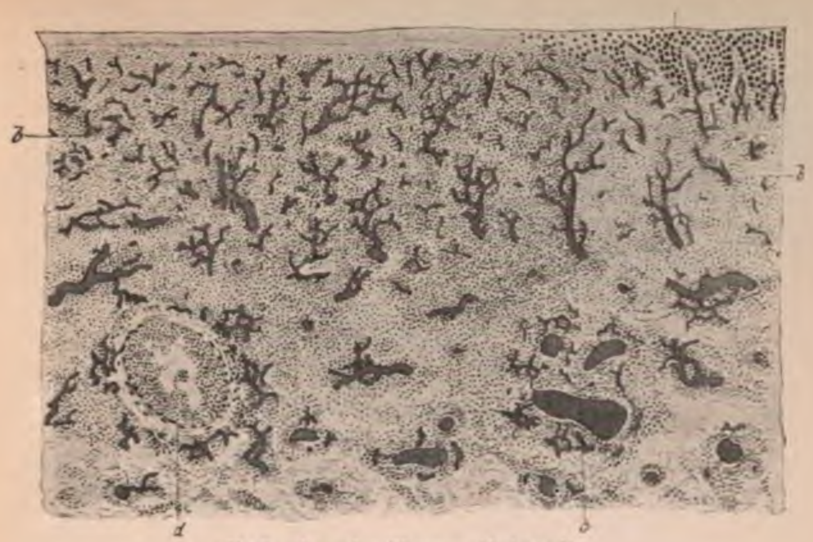
On microscopic examination of a chancre the findings are as follow:—

I. A small round-celled infiltration of the skin and subcutaneous tissues, such as occurs in every inflammation. The infiltration begins in the blood-vessels and spreads outward toward the periphery. For this reason the *form* of the induration depends upon the course of the blood-vessels. When they run horizontally and near the surface, a thin, flat layer of infiltration occurs under the skin, which is called **parchment induration.** On the other hand, when the blood-vessels dip down deeply into the tissues, the induration is extensive and deep, and is called **Hunterian induration.**

II. Changes in the Blood-vessels.—The veins and arteries are both affected by the endarteritis, but the changes are more marked in the arteries. The endothelial cells of their inner coats are swollen and the lumen of the vessel is diminished. The middle coat is usually slightly thickened and infiltrated, but the important change is in the *outer coat,* which is the seat of an infiltration with small round cells.

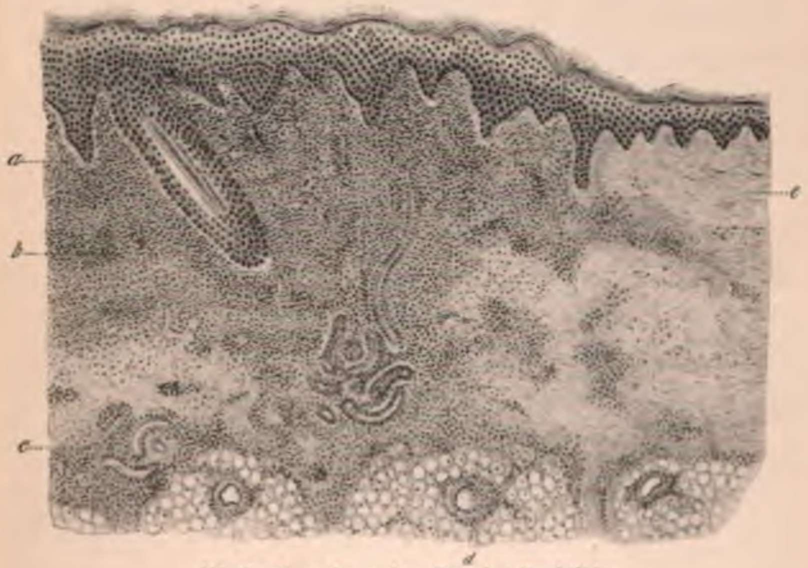
In consequence of all the changes described the circulation of blood is shut off, and coagulation-necrosis, with sloughing of small areas of tissue supplied by the affected vessels, takes place.

It is desirable to understand clearly the pathological changes,



V. Section of a Chancre (Injected).

a, Rete mucosum.
b, Small round-celled infiltration with numerous injected blood-vessels.
c, Blood-vessels with endo- and peri- arteritis.
d, Lymphatics with adventitial and endovascular changes.



VI. Section through a Papular Syphilide.

a, *b*, *c*, Small round-celled infiltration through corium and rete mucosum and around hair-follicles and sweat-gland.
d, Blood-vessel, with infiltration of the adventitia.
e, Normal cutis.

(From "Die Syphilis und die Venerischen Krankheiten," von Dr. Ernest Finger.)

since all syphilitic lesions—including chancre, papule, and gumma—are identical, and are due *primarily* to endarteritis, and, *secondarily*, to the accompanying small round-celled infiltration.

The **lymphatics**, as a rule, are not affected, but remain open and serve to carry the virus, to be deposited in the neighboring gland.

In rare instances an *endo-lymphangitis* occurs, which obstructs the flow of lymph, and occasions a hard, boggy condition of the tissues, causing the so-called *indurative* or *sclerotic œdema*.

The **hardness** and **sclerosis** of chancre are not entirely accounted for by the microscopic findings, because the infiltrating cells are present in spots where no trace of hardness is perceptible to the touch.

Unna attempts to account for the hardness by supposing that a deposit of colloid material takes place around and between the bands of round-celled infiltration in the older parts, but that it is not formed as rapidly as the infiltration advances at the periphery.

The essential characteristics are always the same, but chancres vary considerably in outward appearances, as, for example:—

(*a*) In the amount of induration.

(*b*) In the depth of ulceration.

(*c*) In the amount of inflammation of the surrounding tissues.

Therefore chancre is grouped into several varieties.

VARIETIES.

I. *Dry papule*, which is made up of a very slight amount of induration.

II. *Hunterian chancre.* In this variety, which is named after John Hunter, a considerable amount of induration is present. Its central part is the seat of a coagulation-necrosis, from the endarteritis which occludes the blood-vessels and causes a depression in the centre, which is funnel-shaped, or like the crater of a volcano. The Hunterian chancre is the form most commonly met with.

III. *Parchment chancre.* This form is due to a superficial layer of infiltration lying immediately under the skin and widely spread out in the tissues. It feels like a piece of parchment on being pinched up between the fingers.

IV. *Indurative or sclerotic œdema.* This condition is produced by a combination of the usual endarteritis and small round-celled infiltration, and in addition it is accompanied by an inflammation of the lymphatic vessels or endo-lymphangitis.

The circulation of the lymph is interfered with, and it transudes from the lymphatic vessels into the tissues. This combination of pathological changes gives rise to a boggy condition of the tissues, which is harder and more pronounced than in simple œdema, and, on being pinched between a finger and thumb, a condition of *fibrosis* is felt. Indurative œdema is a rare condition, but occurs more frequently on the female genitals than in men.

CHANCRE HEALS WITHOUT LEAVING A SCAR.

The ulceration and necrosis of the chancre take place at the expense of the newly-formed tissue-elements rather than the normal structures of the parts affected, and consequently no scar results. Chancroids always leave a scar after healing, because the ulceration spreads and destroys normal fixed cells of the part.

DURATION OF THE CHANCRE.

A chancre may heal in a few days or may remain unhealed for many months, especially if it is located under the prepuce, and provided no mercurial treatment is given.

CHANCRE OF THE URETHRA.

Chancre located *within* the urethra is a rare condition, but it does occur at times. It is usually located from one-half to one inch from the meatus, and the only symptom which it occasions is a thin discharge from the urethra, which may be easily mistaken for a gonorrhœa. Examination, however, shows a hard, sclerotic mass surrounding the urethra under the skin, and the nearest lymphatic glands are also enlarged.

A knowledge of the fact that a chancre may be concealed within the urethra will sometimes be of service in explaining the cases of syphilis in which the patient admits having had a slight gonorrhœa, but who denies that he ever had a chancre. In these instances the discharge from the chancre, issuing from the meatus, was mistaken for a urethritis.

DIAGNOSIS.

We should always avoid haste, in making a diagnosis of chancre, and, if any doubt exists, we should await the development of secondary symptoms.

In the case of a sore occurring a few days after coitus it is often impossible to exclude syphilis until at least three weeks have elapsed, on account of the possibility of a *mixed infection* having occurred.

When in doubt as to the diagnosis, we can wait for secondary symptoms—*i.e.*, eruption, mucous patches, alopecia, fever, and headache—to confirm it, or we can make the diagnosis by confrontation.

Diagnosis by confrontation is made by examining the individual from whom the patient acquired the sore, in order to determine the presence or absence of syphilis.

The *most reliable diagnostic points* of chancre may be summarized as follows:—

I. Indolent painless swelling of the nearest lymphatic glands, which are polyganglionic: *i.e.*, arranged in a chain.

II. Induration of the base of the sore, which consists of a hard, cartilaginous induration, and feels like a foreign body imbedded in the tissues.

III. History of the period of incubation, lasting about three weeks.

DIFFERENTIAL DIAGNOSIS BETWEEN CHANCRE AND CHANCROID.

CHANCRE.	CHANCROID.
Incubation:	*Incubation:*
Three weeks.	None.
Commencement:	*Commencement:*
Begins as erosion or papule, which undergoes superficial ulceration.	Pustule or ulcer, and remains so.
Numbers:	*Numbers:*
Single generally. If multiple, so from beginning.	Multiple from beginning or became so by autoinoculation.
Edges:	*Edges:*
Level or sloping and adherent, giving "scooped-out appearance."	Abrupt and undermined.
Floor:	*Floor:*
Smooth, shining, red, or raw; covered with slight deposit.	Rough; worm-eaten; "wash leather" in appearance.
Secretion:	*Secretion:*
Scanty; slightly purulent; not autoinoculable.	Abundant and purulent; autoinoculable.
Progress:	*Progress:*
Slow.	Rapid.

CHANCRE.	CHANCROID.
Induration:	*Induration*:
Constantly present.	None or boggy.
Pain:	*Pain*:
Absent.	Present.
Bubo:	*Bubo*:
Constantly present. (See table in section on "Bubo.")	Occurs in 1 out of 3 cases.
Scar:	*Scar*:
Heals without scar.	Scar always remains.

PROGNOSIS.

It may be stated, in a general way, that the severity of the chancre bears some relation to the gravity of the secondary manifestations. When the chancre is benign, it is probable that the secondary lesions will be superficial and of a mild type, which can be explained in the following way: In a debilitated individual the tissues react more violently to the syphilitic poison, and consequently both chancre and secondaries are more severe, while, on the other hand, the tissues of a vigorous, well-nourished person are in a better condition to resist the action of the poison.

The type of chancre, however, is no indication as to the severity of tertiary lesions, and the severest tertiary accidents often follow a mild chancre.

This is sometimes, no doubt, due to the fact that treatment is often neglected or insufficient in mild cases.

TREATMENT OF CHANCRE.

The cardinal rule in the treatment of chancre is to *avoid every form of irritation*; caustics, strong applications, or mechanical irritants should never be used.

When the chancre is located on the **integument**, a *moist dressing* should be used, consisting of a piece of cotton or gauze, soaked in bichloride solution (1 in 2000), extract of hamamelis, Listerine, Thiersch's fluid, or black wash, and covered with a piece of gutta-percha tissue to prevent evaporation.

If the chancre is located **beneath the prepuce**, a simple dusting-powder of calomel, dermatol, iodoform, or aristol, which is covered with cotton, forms a suitable dressing that absorbs the discharge and prevents the open sore from being infected with pus-organisms.

Mercurial plaster is a useful application to the chancre in any location, and the local contact of the mercury with the chancre induces a certain amount of absorption.

ABORTION OF SYPHILIS AFTER INFECTION.

It is commonly held to-day among syphilographers that it is better to avoid giving mercury internally until the secondary symptoms of syphilis appear. It is impossible to abort the syphilis by the premature use of mercury, and the appearance of the eruption is only retarded.

It is believed by Ehrmann and others that the patient is rendered more liable to tertiary affections if mercury is given before the eruption appears, and, while it is true that its internal administration causes the rapid absorption and disappearance of the chancre, if used too early in the disease, it is detrimental, in the long run, to the patient.

The **early excision of the chancre,** before the appearance of the secondary symptoms, was widely recommended and practiced a few years ago, upon the ground that the virus was strictly localized to the chancre and the tissues in its immediate vicinity, and that the poison might be entirely removed from the body by excising the sore. A more extended experience has shown this to be fallacious, and to-day the procedure is regarded as useless.

CHAPTER XXI.

SYPHILIS.

Syphilis may be defined as a chronic infectious disease, due to a specific poison, [redacted] a micro-organism. Its local manifestations are, primarily, inflammatory changes, beginning in the coats of the blood-vessels and involving the perivascular tissues. After two or three years its contagious element disappears, and the disease assumes the nature of a diathesis.

THE VIRUS.

The virus, or poison, of syphilis is, in all probability, a micro-organism belonging to the class of schistomyceten, although it has not yet been demonstrated with certainty. The proof tests, which bacteriologists insist upon, of isolation of the bacillus, its cultivation, and the subsequent production of the parent-disease by inoculation of the cultivated organism into a healthy animal, have not as yet verified the existence of the specific organism.

CARRIERS OF THE POISON.

The virus of syphilis is contained in the secretions, which are derived from the lesions of the primary and secondary stages, and in the blood, lymph, and semen.

Recent investigations have also shown that the physiological secretions of glands—*i.e.*, the milk, tears, and saliva—do, at times, but only exceptionally, contain the poison. It is of frequent occurrence, however, for the saliva and milk to be contaminated or mixed with the discharges from mucous patches from the mouth or nipple.

Syphilis loses its contagious quality in the tertiary stage, and the blood and secretions from lesions are no longer capable of conveying the disease.

ANALOGY BETWEEN SYPHILIS AND THE ERUPTIVE FEVERS.

A distinct parallel, which has been pointed out by Jonathan Hutchinson, exists in the course of syphilis and small-pox, measles, scarlatina, etc. All these diseases are due to a special and distinct poison, which is introduced into the body. After a period of incubation, during which the virus increases in volume, its quantity becomes so great that the organism is saturated with it, and constitutional symptoms occur. Each disease runs its own definite and self-limited course, and afterward a condition of immunity follows, which lasts for years, or often for the remainder of the life of the individual.

INOCULATION AND COURSE OF SYPHILIS.

After inoculation with the virus of syphilis no symptoms are observed at the point of entrance or elsewhere for a period of *at least three weeks.*

It is supposed that at this time the micro-organisms are too few in number to cause any reaction of the tissues, but, as they increase in number, they induce a condition of local irritation, and the chancre appears. The virus continues to increase, is taken up by the lymphatic vessels and carried to the nearest lymphatic glands, which serve as incubating places for the micro-organisms. The glands undergo enlargement successively, and ultimately the virus reaches the general blood-circulation.

When saturation of the blood has occurred, the fact is announced by prodromata, which are soon followed by an eruption on the skin and mucous membranes, and later the eye, periosteum, and viscera are attacked by inflammatory changes, consisting in arteritis and small round-celled infiltration.

The eruption remains upon the skin for from four to six weeks ordinarily, and then disappears, and for a time no symptoms of the disease are present. This interval in the manifestation is spoken of as a **period of latency.**

It is supposed that the poison which had been circulating in the blood was either eliminated or neutralized by the antitoxin formed in the body, but that a certain quantity of virus still remained stored up in the lymphatic glands. As this stored-up virus increases in quantity, fresh discharges of it are thrown into the blood-current, saturation again takes place, and a **relapse** occurs.

Relapses followed by periods of latency occur at intervals of from three to six months during the entire course of the disease, and it is noted that relapses are more apt to take place in patients who have had little or no treatment.

In the majority of cases which receive systematic and adequate treatment relapses cease after from one to three years. But it does not necessarily follow that the syphilis is at an end because a considerable length of time passes without a relapse. After a period of latency, which may extend over many years, new symptoms may again develop.

The *late lesions* differ from the early ones in that they are of a grave nature and do not tend to spontaneous recovery, but are more apt to destroy the organs attacked. The secretion which they furnish has also lost its contagious properties.

MODE OF INCREASE OF THE VIRUS.

After reaching the blood-current the virus has the property of passing through the walls of the blood-vessels by osmosis, and is deposited at various points in the tissues. Wherever the virus is deposited local inflammatory infiltration occurs.

As the virus is in these various spots, their secretions and *detritus* can produce syphilis if inoculated into another individual. As a consequence of the growth and activity of the bacteria which we assume to be the cause of syphilis, and which are believed to increase and multiply in the chancre, lymphatic glands, and all secondary lesions, **toxins** are produced which have a poisonous effect upon the nervous system, and occasion fever, headache, and backache.

STAGES OF SYPHILIS.

It is found convenient to divide the regular course of syphilis into three stages, as follows:—

I. Primary stage, which includes the time from the moment of infection to the outbreak of general symptoms (eruption and mucous patches, etc.), and which lasts from eight to ten weeks.

For the first three weeks of the primary stage there are no symptoms to indicate that the individual contains the virus of syphilis in his tissues. At the end of three weeks the chancre appears, and the adjacent glands become enlarged and are the only signs of infection.

II. The secondary stage begins when the eruption, alopecia, and mucous patches make their appearance. It is the stage of typical and regular development of eruptions and their accompanying symptoms, and periods of latency alternate with relapses. The secondary stage lasts from six to eighteen months, or about one year on the average.

III. The tertiary stage comes on after a prolonged period of

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latency, and is the stage of formation of gumma. The tertiary stage may never occur. Its secretions are not contagious, and it resembles a *diathesis* more than an active disease.

INCUBATION.

Definition.—The period of time which elapses after the poison has entered the body and until the first manifestation of its working appears. The poison is not inactive during this time, but increasing in quantity.

The primary stage of syphilis is divided into two periods of incubation:—

(*a*) *Period of primary incubation,* which is the period from the time of infection until the chancre appears. The chancre represents the reaction of the tissues in consequence of the local increase of the virus.

(*b*) *Period of Secondary Incubation.*—This is the time from the appearance of the chancre until the eruption is seen. The eruption indicates that the blood is saturated with the virus.

GLANDULAR ENLARGEMENT.

The lymphatic glands are supposed to act as places for the incubation, growth, and development of the syphilitic virus and to serve as store-houses for it, during the entire secondary stage. The glands nearest the chancre begin to enlarge about four weeks after infection.

General Characteristics.—The glands become:—

(*a*) Firm and hard.
(*b*) Freely movable under the skin.
(*c*) No pain.
(*d*) Rarely suppurate except in strumous or weak patients.

The glands nearest the chancre become enlarged first; consequently we find that, when the chancre is located on the *penis,* the *inguinal* glands enlarge first; when the seat of the chancre is on the *breast,* the *axillary* glands are the first to become affected; and, if the chancre is located on the tongue or lips, the *submaxillary* glands are first attacked.

The **lymphatic vessels** lying between the glands often become hard and indurated, feeling like cords, and this condition is called *lymphangitis.*

Course of Virus Through the Lymphatic System.—The syphilitic virus pursues the following course, in its progress through the lymphatic vessels into the general blood-circulation:—

The small round-celled infiltration, which occurs in the chancre, closes up the mouth of the blood-vessels and temporarily holds in check the spread of the poison. The multiple swelling of the lymphatic glands also retards the entrance of the virus into the blood-current.

After the virus begins its increase in the chancre, a part of it is carried to the nearest lymphatic gland, which is a favorable spot for its growth and increase. Part of the virus which is deposited here remains and a part travels farther to the next lymphatic gland.

When the chancre is located on the *penis*, the course of the virus is as follows: Through the inguinal glands, lymphatic glands in the abdominal cavity, receptaculum chyli, and thoracic duct, from which it is poured into the left subclavian vein and general blood-circulation.

During this time the cervical and axillary glands have had none of the virus passing through them. After the blood has become charged with the virus, they filter out the poison, are infected, and become enlarged in consequence.

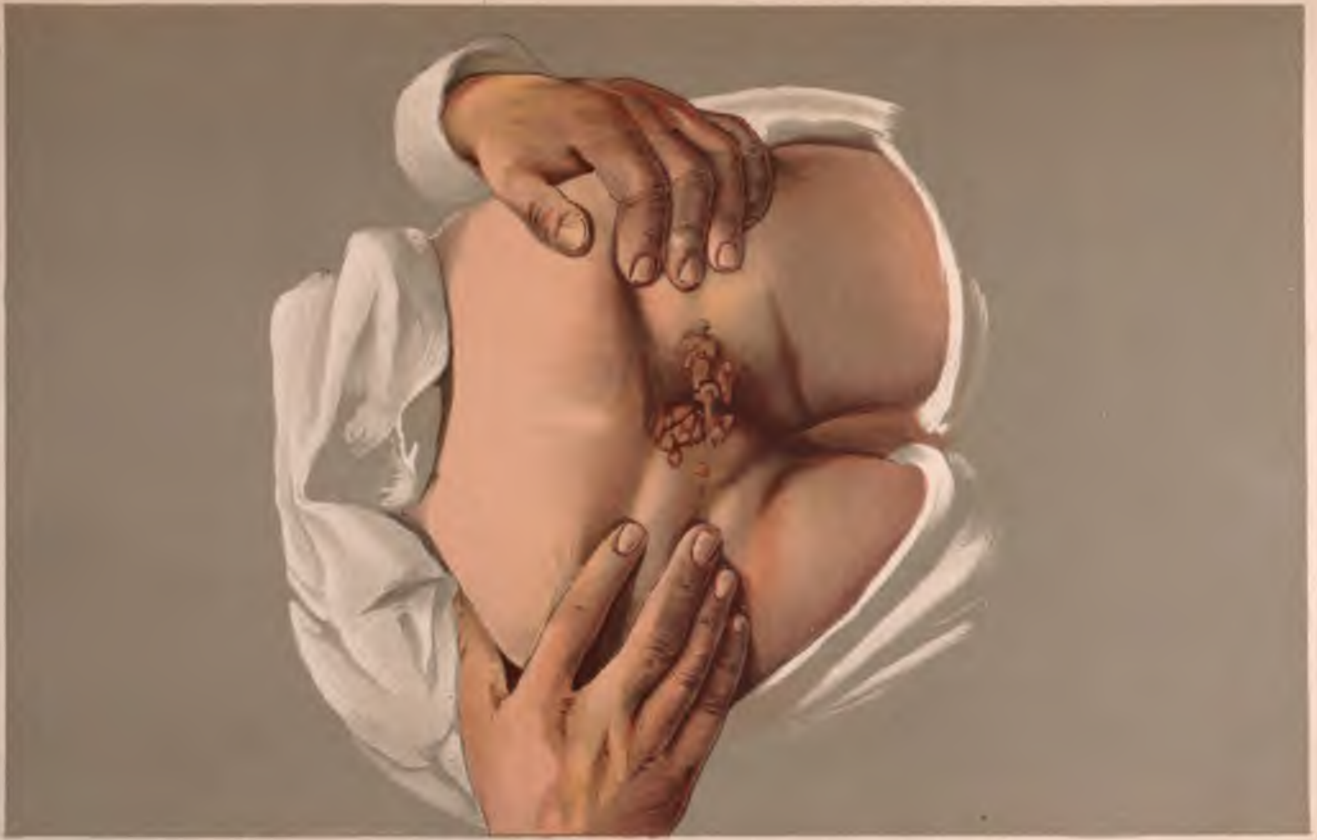
SECONDARY SYPHILIS.

PRODROMAL SYMPTOMS, OR PRODROMATA.

The virus of syphilis has the power of destroying the red corpuscles after it has entered the blood-circulation, and on microscopic examination we find that the red corpuscles are diminished in number, with a decrease of hæmoglobin, and that the number of leucocytes is increased. In consequence of these changes the skin and mucous membranes appear *pale* and *anæmic.*

Fever is present in nearly every case. It is usually slight in well-nourished and strong individuals, but in debilitated subjects may reach 103° or 104° F.

Nocturnal Pains.—The shafts of the long bones, such as the tibia and ribs, and the vertex of the cranium are usually affected with pains which are more or less severe, and which have the peculiarity of *remitting through the day and coming on at night, and reach their maximum intensity about midnight.*



CONDYLOMATA LATA, or Syphilitic Papules around the Anus (Author's Case from King's County Hospital).

The pains are boring or tearing in character, and are called osteocopic pains (bone-tearing).

Jaundice occurs in a small proportion of cases, and, while its cause is not definitely ascertained, it is assumed to be due to *either* (*a*) pressure upon the common bile-duct, from the enlarged lymphatic glands lying in the abdomen, or (*b*) from congestion and swelling of the mucous membrane lining the common bile-duct, as a result of the disturbed circulation.

Albuminuria occurs occasionally. It is temporary in character and is due to congestion of the kidneys.

Erythema of the fauces is a most constant symptom, and appears as a generally diffused erythematous redness upon the pillars of the fauces and the pharynx.

All the symptoms described above under the term *prodromata* appear before the eruption and mucous patches, and are all occasioned by a disturbance in the local blood-supply, which induces a condition of hyperæmia or active congestion in the various organs affected.

The mucous patch is one of the most constant and characteristic lesions of secondary syphilis. It makes its appearance about the same time that the eruption is observed. In the earliest stage the mucous patch appears as a pearly-white round spot upon the mucous membrane of the mouth, entrance to the vagina, margin of the anus, or under the female breast. Its development may occur wherever the skin is thin and delicate and kept macerated by secretions.

As it is seen first, the mucous patch looks as though nitrate of silver had been brushed over the surface. After a little time, the infiltrated pellicle of mucous membrane sloughs off, leaving a shallow, sharply-defined, "punched-out-looking" ulcer. This might be regarded as the second stage of the process, and is the form in which the mucous patch is most commonly seen.

The condyloma may be looked upon as the third stage in the development of the mucous patch, and is brought about by the active growth and proliferation upon the floor of the ulcer. The result is the formation of cauliflower-like granulations, which rise in little hillocks, above the level of the surrounding healthy skin.

The secretion which is very abundantly furnished by mucous patches and condylomata is highly contagious, and is responsible for the transmission of most of the cases of syphilis.

ALOPECIA.

In many cases of early secondary syphilis, although not invariably, the hair falls out to a greater or less degree.

It is due to two different causes:—

(*a*) The impaired quality of the blood fails to afford sufficient nourishment for the hair-bulbs, and they die.

(*b*) An increased secretion of sebum takes place around the bulb, and by its pressure shuts off the circulation of the nutrient fluid in the shaft of the hair.

Alopecia occurs in various forms. It may be ***complete,*** in which case the hair of the head, eyebrows, and pubes may fall out entirely. The *usual* form, however, consists in a patchy baldness, the hair falling out in small patches of the size of a finger-nail. In some cases there is only a general thinning of the hair, without the formation of any distinct bald patches.

The *prognosis* is good, and the hair always grows in again, unless an ulcerative process has taken place upon the scalp and destroyed the hair-follicles.

SKIN ERUPTIONS, OR SYPHILIDES.

The appearance of the rash upon the skin announces that the blood is saturated with the virus of syphilis. The eruption is supposed to be caused primarily by the irritating effect of the virus upon the vasomotor centres, causing a local paralysis and temporary dilatation of the arterioles in the skin, with inflammatory changes within and around the vessel, at the spot where each lesion is located.

Microscopically all the eruptions of syphilis are identical, and vary in outward appearances only because of the difference in the amount of cellular infiltration.

On microscopic examination all the lesions are found to be due to *two distinct morbid processes:*—

(*a*) Inflammation in the outer and inner coats of the arterioles, accompanied by stasis of blood or hyperæmia in the capillaries.

(*b*) An infiltration of small round cells, as the result of the inflammatory process, which begins in the arterioles and spreads outward toward the periphery, in the tissues surrounding the vessels. At times the changes of arteritis and cellular infiltration are so great that the circulation of blood through the vessels is cut off, and the parts supplied become the seat of coagulation-necrosis and slough out.

Classification and Anatomy of Eruptions Occurring in the Secondary Period. — *I. Macular Syphilide.* Synonyms: Syphilitic erythema; syphilitic roseola.

The pathological change in the skin which is the seat of a macular syphilide consists in periarteritis and endarteritis, with an excess of blood in the capillaries; but, while the round-celled infiltration has taken place in the tissues, it is so slight in amount that it can only be detected by microscopic examination.

When a considerable amount of round-celled infiltration has been produced, it is readily perceptible, and forms nodules or small tumors, which are spoken of as the

II. Papular Syphilide. — The papules forming this variety of syphilide may be as large as a 10-cent piece or as small as a pin's head, and are accordingly classified as the *large* or *small papular syphilide.*

In certain cases the epidermis covering the papule scales off, but remains partly attached, and the syphilide is then spoken of as *papulo-squamous.*

If the centre of the papule becomes necrotic and breaks down, a funnel-shaped depression is formed, which is filled with pus and covered over by a scale of epidermal covering. This variety is known as the *papulo-pustular syphilide.*

III. The Pustular Syphilide.—The pustular syphilide is formed from a pre-existing papule whose central part undergoes necrosis and, as a result of obliteration of the arterioles from endarteritis and periarteritis, sloughs and breaks down. The process is then complicated by the inoculation of pyogenic micro-organisms. These cause a suppuration of the central part of the papule, and the accumulation of pus, which forms underneath a covering of epidermis, which is raised up above it, preventing its escape.

IV. The Pigmentary Syphilide.—This form of syphilide should not be confounded with the pigmentation which remains after the disappearance by absorption of a papule.

The pigmentary syphilide occurs as an independent eruption upon a spot which was not previously affected. It is occasioned by the endarteritis and periarteritis, which allows the red corpuscles of the blood to escape through the vessel-walls into the tissues. The hæmoglobin of the escaped blood becomes dark brown in color, occasioning a pigmented appearance of the skin, and is ultimately absorbed, leaving the skin whiter in appearance than before.

The pigmentary syphilide occurs in *two forms*:—

(*a*) As dark spots or patches of brown pigmented skin.

(*b*) As a diffuse, wide-spread, dark pigmentation, with areas of healthy white skin scattered here and there through it. In this form (*b*) absorption of the hæmoglobin has taken place in certain areas of the pigmented patch, leaving white spots free from pigment.

Distribution of Syphilides over the Body.—The portion of the skin attacked and the extent of the eruption depend upon the age of the syphilis.

The early eruptions which occur during the first six months are:—

(*a*) Superficially seated in the skin.

(*b*) Generally distributed over the body, appearing first upon the chest and abdomen and spreading subsequently to the palms and soles.

(*c*) The eruption is symmetrical, occurring alike on both sides of the body, and tends to arrange itself along the course of the connective-tissue bundles which lie under the skin (called lines of cleavage).

(*d*) The early eruptions generally disappear spontaneously by absorption.

Relapsing Syphilitic Eruptions. — The relapses occur after the first six months, and differ in the following particulars from the early eruptions:—

Distribution.—(*a*) While they may be distributed over the entire body, the relapsing eruptions are never so numerous as the early lesions.

(*b*) They do not follow the lines of cleavage, but are arranged in circles or segments of circles.

(*c*) The groups of lesions do not tend to arrange themselves symmetrically, as a rule, but have certain *spots of predilection*, such as the genitals and anus, the mucous membrane of the mouth, the palms and

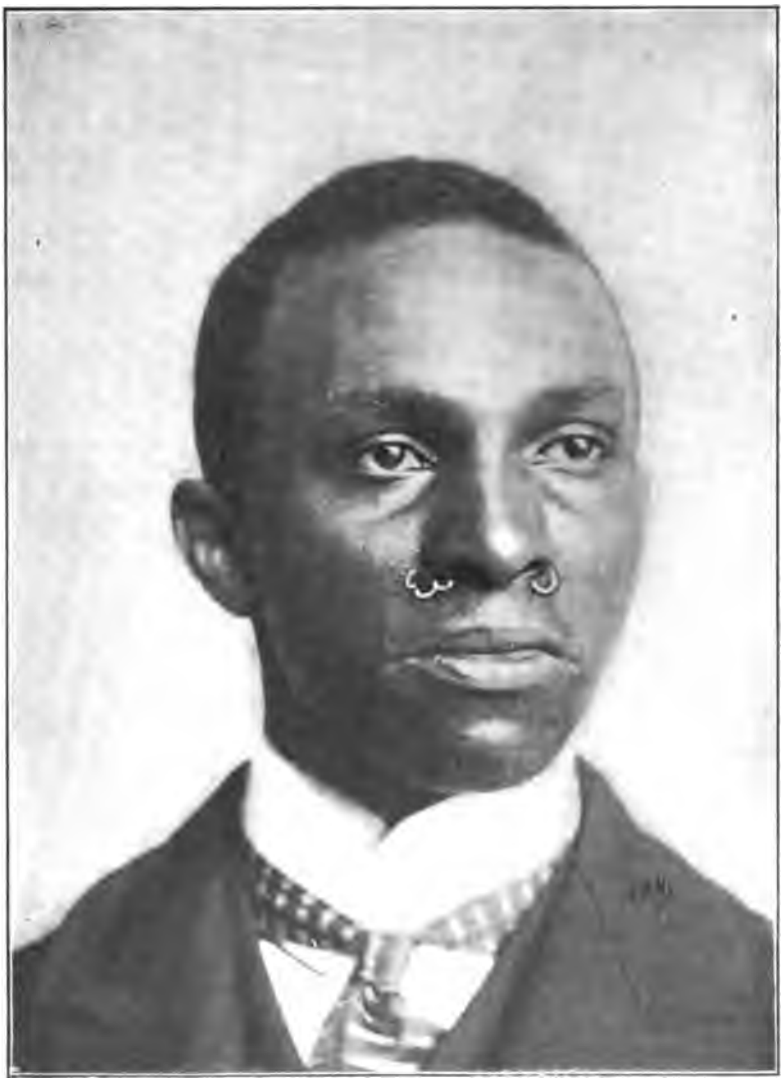


Fig. 87.—Circinate Syphilide. An Early Secondary lesion, and variety of the Macular form of Syphilide. (Author's Case, from Polhemus Clinic.)

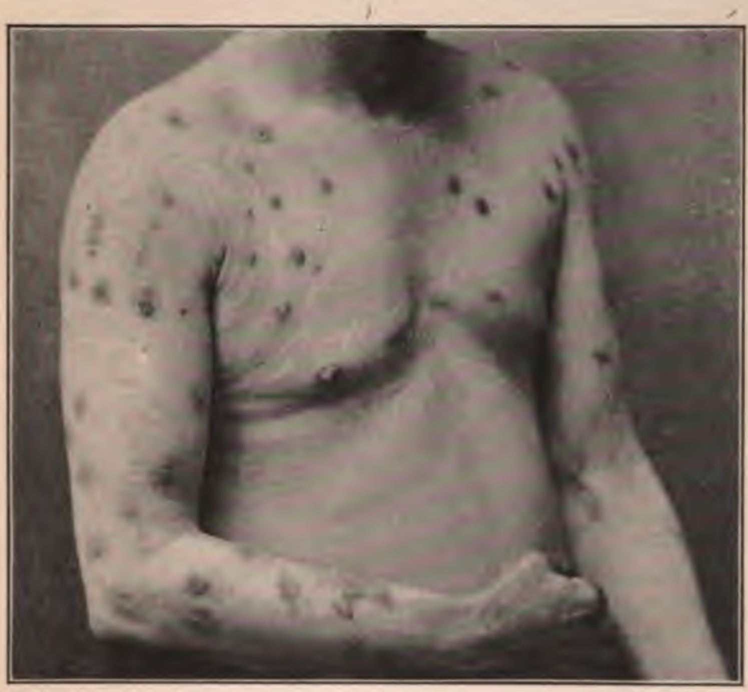


Fig. 88.—Large Papular Syphilide. (Courtesy of Dr. Colby.)

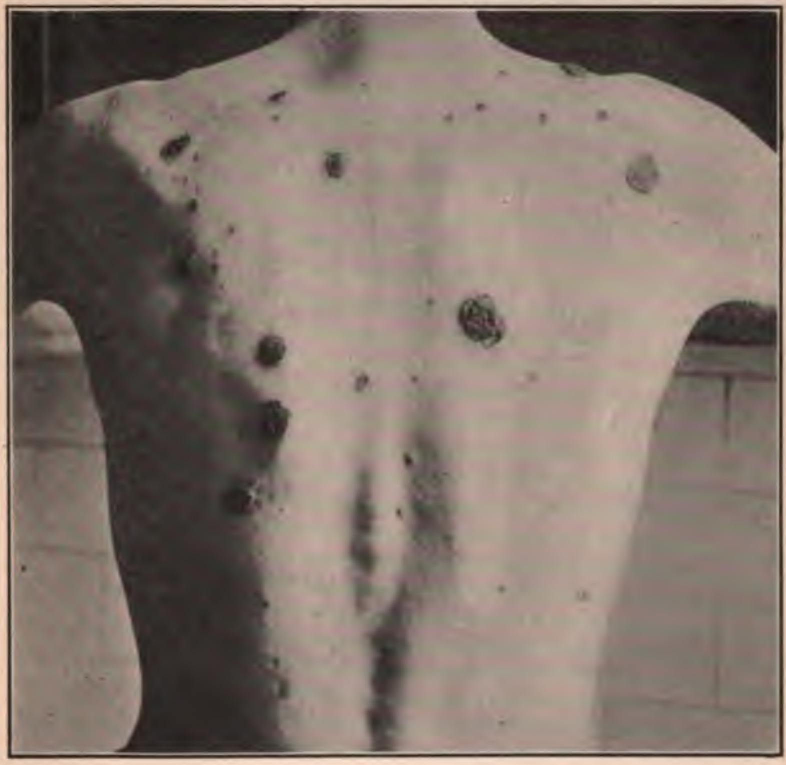


Fig. 89.—Malignant Syphilis. Pustular Eruption. (Author's Case, from Polhemus Clinic.)

soles, the upper margin of the forehead near the hair, and the flexures of joints.

(*d*) The later eruptions are less apt to be absorbed than the early lesions, but tend rather to break down and ulcerate.

Course of the Eruption. — Syphilides are temporary formations which grow and spread at the periphery, or outer edge, and after reaching a certain height *absorption* or *ulceration* takes place, beginning in the centre.

In this way the *ring formation* occurs. The centre, or oldest part, has been absorbed and disappeared, leaving the most recently formed portion of eruption still present as a ring around the healed centre.

Retrogressive Changes of Syphilides.—As stated above, the process of absorption always begins in the *centre* of the lesion.

The *macular* syphilide disappears most readily, and, if a pigmentation were formed, it is soon absorbed, leaving the skin *whiter* than normal.

In the *papule* the central part is absorbed, leaving a depression, which is filled with epidermal scales.

The *pustule* is formed from a papule, and has a crater-like depression in its centre filled with pus; this dries up and forms a crust, and the surrounding ring of infiltration is removed by absorption.

The papule and pustule leave traces of their presence, as spots of pigmentation, which remain on the site of the original lesion for a long time.

If the pustule has caused much necrosis of the normal cutaneous elements, a cicatrix will be formed.

Symptoms of Syphilides. — I. Arrangement of the lesions. II. Polymorphism. III. Color. IV. Absence of burning and itching.

I. The *arrangement* has already been considered, and depends entirely on whether the syphilide is early or one of the later relapsing eruptions.

II. Polymorphism is the most valuable diagnostic sign of a syphilide, and pertains to both early and late varieties of eruption. Polymorphism may be defined as *diverse as to form*, and is brought about in the following way: The eruption in syphilis never comes out all at once, but makes its appearance in successive crops. When the eruption is viewed, if it has lasted for some little time, it may be noticed that the *older* spots have undergone transformation, while in the *later* spots the changes are less marked. Hence we find present at the same time macules, papules, and pustules, and the lesions are all of different ages and various stages of development or retrogression.

III. Color.—The color of syphilides is frequently compared to that of an old copper cent or of lean raw ham. The color is by no means pathognomonic, as it occurs in most inflammations of the skin which are chronic. It is occasioned by the arteritis, which weakens the vessel-walls and allows the red corpuscles to pass out into the surrounding tissues. The hæmoglobin loses its bright-red color and becomes brown.

IV. The absence of burning and itching is not invariable, but is usual, and is accounted for by the slow chronic character of the development of the lesions.

Duration of Secondary Stage.—The secondary stage lasts a variable length of time, which may be from six to eighteen months, and may be set down as about one year, on the average.

In cases which follow a favorable course *relapses* cease to occur, and the disease appears to be at an end.

It is not possible to draw any distinct line of demarcation between the secondary and tertiary periods, for as the lesions continue to recur they gradually lose the distinguishing characteristics of secondary syphilis and become distinctly tertiary.

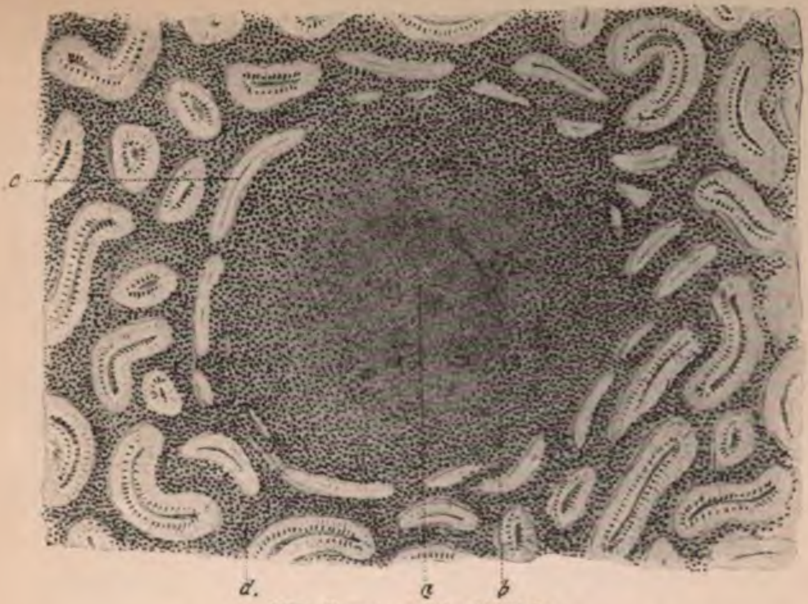
In the secondary stage the visible manifestations of the disease occur chiefly upon the skin and mucous membranes, and, while the viscera, eyes, and nervous system are occasionally attacked, they are not apt to be affected.

In the tertiary stage, however, the affections of the skin are trivial in comparison with the damage which may be wrought in other vital organs.

TERTIARY STAGE.

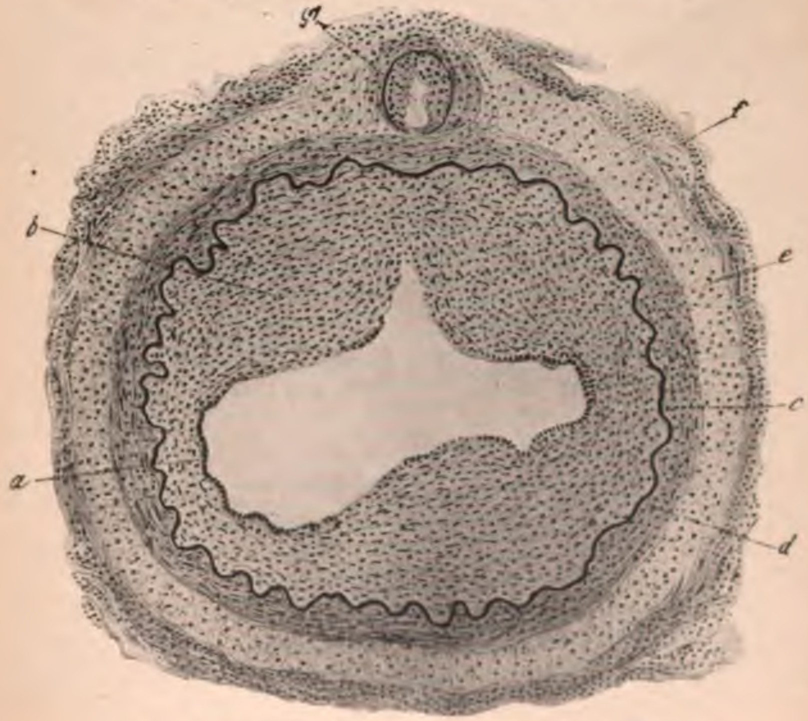
Individuals who are strong and well nourished and who are systematically and carefully treated for a sufficient length of time rarely develop tertiary symptoms.

Tertiary lesions are said to occur in from 5 to 40 per cent. of cases of syphilis. The most usual time for their appearance is from three to five years after infection, although long periods of latency,



VII. Gumma of the Testicle.

a, Central portion, seat of coagulation-necrosis. *b*, Peripheral zone formed by infiltration of small round cells. *c*, Compressed tubuli seminiferi. *d*, Interstitial small round-celled infiltration.



VIII. Endarteritis (Artery from the Fissure of Sylvius).

a, Swollen and infiltrated endothelial lining. *b*, New formation composed of connective tissue and small round-celled infiltration. *c*, Membrana elastica. *d*, Muscular coat. *e*, Media. *f*, Adventitia. All above layers infiltrated with small round cells. *g*, Nutrient artery (*vas vasorum*).

(From "Die Syphilis und die Venerischen Krankheiten," von Dr. Ernest Finger.)

even as much as fifty years, during which the patient is entirely free from symptoms, may intervene before the tertiary lesions appear.

Characteristics of Lesions of Skin and Mucous Membrane.—The characteristics of the syphilides in the tertiary period differ greatly from the secondaries, and may be summarized as follows:—

I. They attack a limited area.

II. They have a tendency to extend and cause destruction of tissue, with the formation of scar-tissue and its subsequent contraction.

III. They do not tend to spontaneous recovery, but rather break down and ulcerate.

IV. They extend deeply into the tissues.

Tertiary lesions, in whatever organ or structure of the body they may occur, are the direct result of chronic vascular lesions, and are commonly accompanied by the so-called gumma.

PATHOLOGY.

Arterial Changes. — In the tertiary period of syphilis arteritis plays an important rôle. In the *secondary period* the inflammatory changes in the vessels are more apt to involve the *adventitia*, but in tertiary syphilis the *inner* coat is more liable to be attacked.

The chronic inflammation of the vessel-walls causes an infiltration of small round cells to take place between the *intima* and the *endothelial lining* of the artery, and this infiltration ultimately becomes organized into connective tissue. The contraction of the tissue thus formed causes a narrowing of the calibre of the artery, and, indeed, it may lead to the total closure of its lumen, and the vessel becomes transformed into a solid string of connective tissue (endarteritis obliterans).

When the arterial wall is the seat of an inflammatory process which is very *circumscribed*, instead of its lumen becoming narrowed or obliterated its walls may be stretched and dilated, and in this way small *miliary aneurisms* are formed.

Gummous arteritis is a rare affection, consisting in the formation of small gummata, which grow from the media and push upward, covered by the unchanged intima, into the lumen of the artery. The centre of the gumma generally becomes cheesy and breaks down. Obliterating endarteritis can also exist at the same point in the vessel in addition to the gumma.

Gumma[1] is always preceded by and dependent upon the arteritis. It occurs especially in the skin, periosteum, meninges of the brain and cord, and the abdominal viscera, particularly the liver, spleen, and testicle.

The gumma consists of a circumscribed mass of new tissue, varying in size from a pin's head to a hen's egg, and is composed of a hyaline matrix, in which are imbedded small round cells and occasionally giant cells. Small gummata may disappear by absorption, but, in gummata of larger size, the nutrition of the central parts of the tumor is cut off, by the pressure of the hyperplastic tissue on the blood-vessels and by the accompanying endarteritis, and the centre of the tumor undergoes coagulation-necrosis.

After a gumma has lasted for some time, it is found to be composed of an old central part made up of fatty, cheesy, broken-down cells and an outer zone which has been transformed into a fibrous connective-tissue envelope surrounding the softened sloughing centre.

A gumma may exist singly or there may be several present, lying close together. The circumscribed form of gumma developing in the skin is termed a *syphilitic tubercle.*

CLASSIFICATION OF SKIN ERUPTIONS.

The eruptions which occur upon the skin in tertiary syphilis are all occasioned by the formation of gummata in the skin or subcutaneous connective tissue and their subsequent progress of ulceration, and are classified as follows:—

I. Gumma: (*a*) Of the skin. (*b*) Subcutaneous tissue.
II. Tubercular syphilide: (*a*) Dry or atrophic. (*b*) Ulcerative.
III. Rupial syphilide.

(a) Gumma of the Skin. (b) Gumma of the Subcutaneous Tissues.—Gumma of the subcutaneous tissues is the cause of the deep

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[1] The name of infectious granulomata was given by Virchow to a class of diseases whose development does not pass beyond the stage of *formation of granulation-tissue,* which is transitory in the character of its duration and ends by ulceration. In addition, it is nearly allied in its formation to the process of inflammation. The class of infectious granulomata includes syphilis, tuberculosis, leprosy, actinomycosis, mycosis fungoides, rhinoscleroma, and glanders.

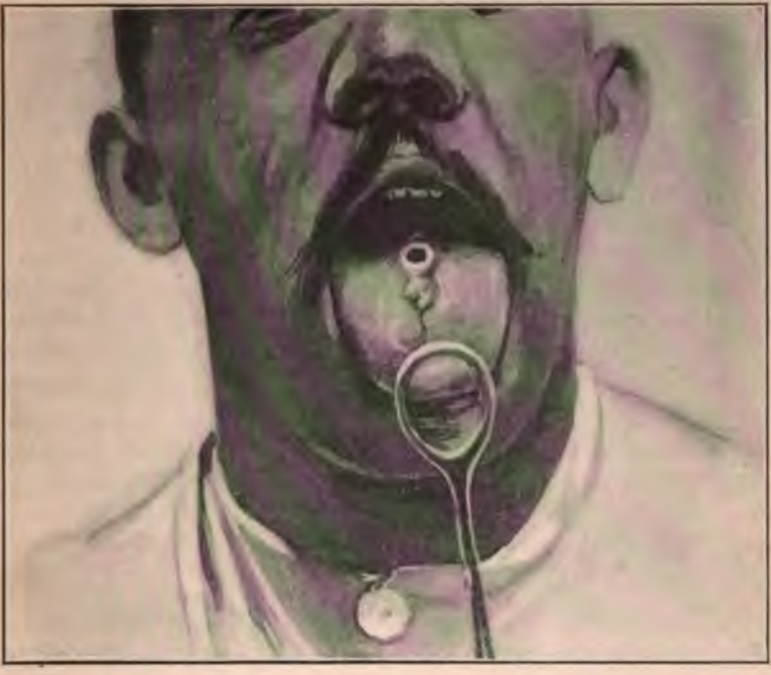


Fig. 90.—Gummata of the Tongue. The one in the middle has undergone Coagulation-necrosis of its centre. (Author's Case, from Kings County Hospital.)

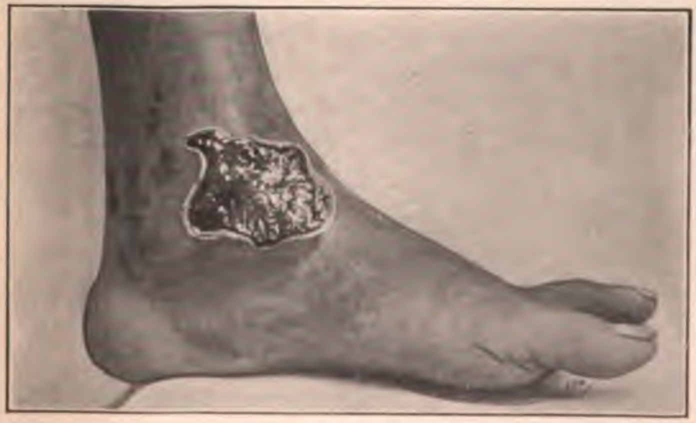


Fig. 91.—Ulcerating Gumma of the Ankle. (Author's Case, from Kings County Hospital.)

ulcerations commonly met with in tertiary syphilis. The skin lying above the gumma becomes attached to it by the inflammation, softens, and sloughs away, exposing to the air the cavity which was formed in the central part of the gumma, by the coagulation-necrosis of the new infiltrating cells. As the ulcers heal, a cicatrix is formed which dips down into the cavity of the gumma and a depressed scar, attached firmly to the subcutaneous tissues, remains at that point.

The circumscribed form of gumma which develops in the skin is termed a syphilitic tubercle. This condition is entirely distinct from tuberculosis of the skin, which depends upon the tubercle bacillus, and in this instance the word tubercle means a little tuber, or small nodule. The tubercular syphilide appears in two forms:—

(a) Dry, or atrophic, tubercular syphilide, which is so called from the fact that it does not break down and undergo destruction, but tends to dry up and disappear by absorption.

It is this variety of syphilide which occasions the ringed form of eruption which comes on late in the course of the disease. (See plate.)

(b) The ulcerative form of tubercular syphilide takes its name from the fact that, unlike the atrophic form, it is not absorbed, but breaks down and ulcerates, continually spreading farther at the edge and healing in the centre. From its tendency to extend at the periphery and involve fresh areas of tissue it is sometimes termed the *serpiginous syphilide.*

The rupial syphilide derives its name from the concentric rings of crust which form the scab, resembling the rings of an oyster-shell. The formation of the rings occurs in this manner: A small gumma forms in the skin, ulcerates, and the ulcer is covered with a crust. The ulceration extends at the periphery; a ring of crust is formed over the new ulceration and lies underneath the first crust, and as it is larger in size, projects all around it. As the ulceration extends, other layers of crust are formed underneath the original ones, and each additional crust which forms is larger in diameter than the one preceding it, and is not entirely covered, so that the edge is seen forming a ring around the crust above it.

The lesions above described are all deeply seated, involve the subcutaneous tissues, and result in more or less destruction of tissue, which is healed by the formation of contracting cicatrices.

SYPHILIS AND IRRITATION.

The predilection which syphilitic lesions seem to show for certain structures may be partly accounted for in the following way: It has long been noticed that any irritation or trifling form of injury in a syphilitic individual predisposes toward the formation of lesions at the injured or irritated point. Frequent examples may be called to mind, as, for instance, the effects of smoking or the friction from broken teeth in causing sores in the mouth. Pressure contact, if oft repeated and prolonged,—as, for example, the pressure of the forearm upon a desk, in a clerk or book-keeper,—predisposes to the appearance of an eruption upon the skin of the forearms. A slight blow or squeeze may induce the formation of gumma in the bones or testicles, and, as would naturally be expected, the bones which lie near the surface of the skin—such as the tibia, ribs, and skull—are more apt to be affected by periostitis than the bones which are abundantly covered by a thick cushion of muscle and fat.

Syphilitic lesions also, by preference, affect the *point of least resistance* in the organism. Thus, for instance, syphilis of the liver is more frequent in alcoholics than in abstemious persons, and syphilis is particularly liable to attack the brain and its meninges in individuals who are mentally active and are brain-workers. For the same reason a relapse of a syphilis, which has been latent for some time, is often induced by an attack of malnutrition brought on by want and privation.

MALIGNANT SYPHILIS.

Syphilis is said to be malignant when it pursues a rapid, destructive, and uncontrollable course from the outset, and it only occurs in individuals who are debilitated from tuberculosis, alcoholism, or bad nutrition and privation. Its severity is increased from the fact that such cases do not tolerate the administration of mercury and iodide of potash well.

The early lesions are generally distributed over the body, are pustular in character, break down, and cause extensive ulcerations. The anæmia from the destruction of the red corpuscles is very marked,

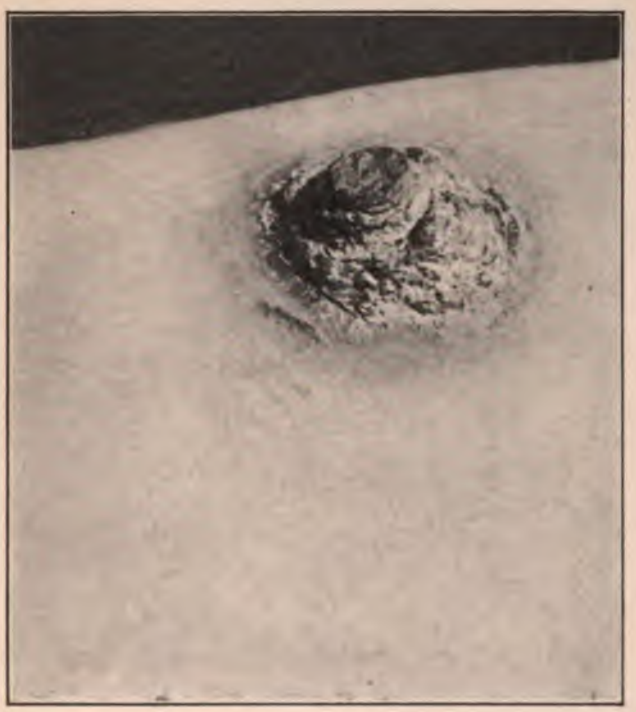


Fig. 92.—Rupial Syphilide. (Author's Case, from Polhemus Clinic.)

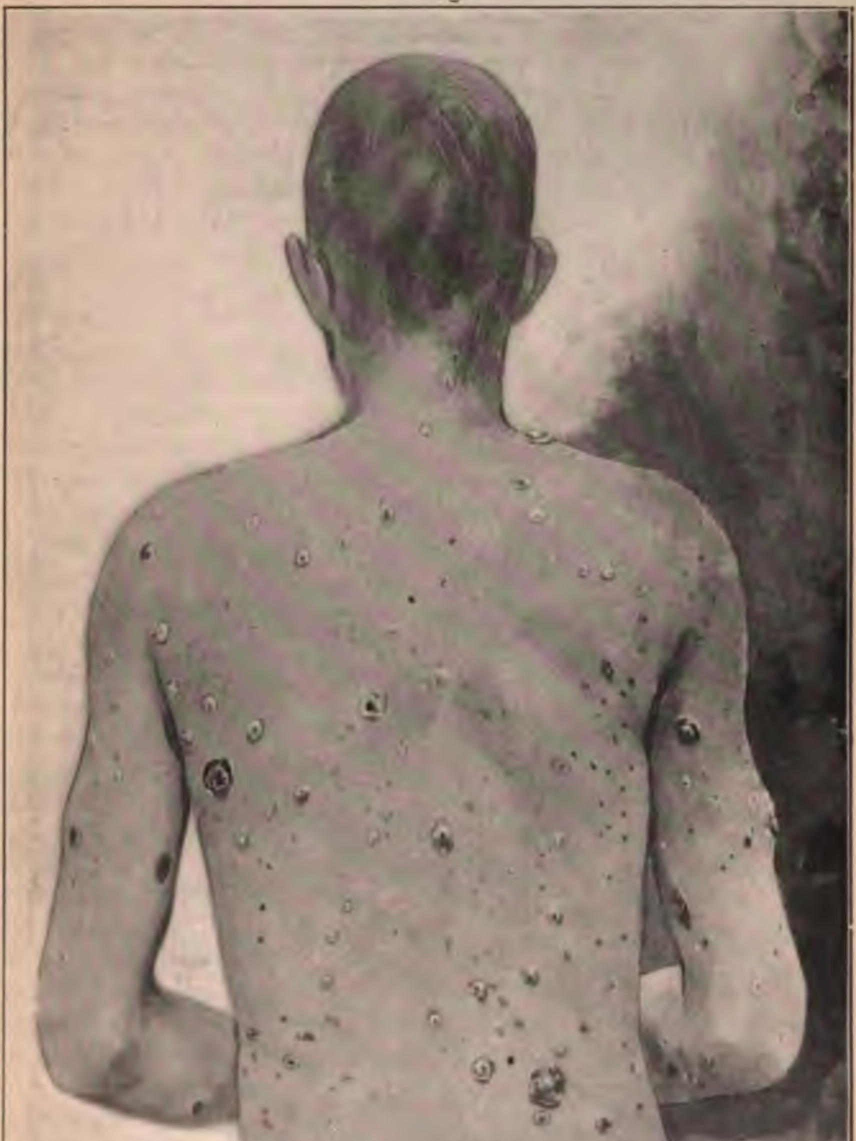


Fig. 93.—Pustular Syphilide (Malignant Syphilis). (Author's Case, from Kings County Hospital.)

and the cachexia is strikingly evident. The subcutaneous fat is absorbed, and the patient emaciates.

Gummata develop prematurely, and four or five months after infection the most extensive, wide-spread forms of gummatous ulceration may be present. Death may result from destruction of some vital organ, or the prolonged suppuration of the ulcers may cause death from amyloid or fatty degeneration of the viscera or general marasmus.

If the resistance of the system be enough to withstand the drain for two years, the virulence of the disease is exhausted, and the patient may live, but in a weak and debilitated condition of body.

In the foregoing sections we have considered the manifestations of syphilis in the skin and mucous membranes only, but, as has already been indicated, the lesions of syphilis are not confined to any one structure.

The pathological processes of endarteritis and periarteritis, with their accompanying cellular infiltration of tissue and the resulting degenerative changes in neighboring structures, as well as the gummatous infiltration occurring in the later period of syphilis, are liable to attack any organ in the body, and the symptoms resulting depend wholly upon the function of the organ attacked.

For syphilitic affections of the muscles, joints, and breast the reader is referred to the treatises on surgery, and to the works on internal medicine for an account of syphilitic disease of the liver, heart, spleen, etc.

The diseases of the nervous system, eye, and ear which depend upon syphilis for their causation are best studied in the special textbooks devoted to those subjects.

IMMUNITY IN SYPHILIS.

Immunity may be defined as *the condition of body which resists the growth and pathogenesis of disease-producing germs.*

As in all other infectious diseases, one attack of syphilis protects against others, and it is an event of the greatest rarity for a second infection to occur. The essential nature and cause of immunity, in any infectious disease, is still a matter of speculation. There are three theories at present to account for it:—

I. Phagocytosis.

II. The bactericidal power of the blood.

III. The antitoxins.

The latter theory is not fully established, but is more generally accepted than either of the others. It is known that bacterial action and growth produce substances called *toxins*, which are poisonous. It is supposed that another set of chemical substances called *antitoxins*, or *defensive proteids*, is being formed at the same time. The antitoxins do not destroy the toxins, but exert some action upon the tissues of the body which causes them to be insusceptible to the action of the toxins.

Immunity may be acquired in three ways:—

I. By means of a first attack.

II. By means of **heredity,** which is the so-called **inherited immunity,** and is demonstrated by the fact that occasionally healthy children are born of syphilitic parents, because the fœtus has acquired its immunity *in utero.*

III. **Acquired Immunity.**—It sometimes happens that healthy mothers who become pregnant with a syphilitic child (infected with syphilis and generated by a syphilitic father at the same time) *may* acquire immunity through absorption of the syphilis antitoxins which had been formed in the fœtus.

INHERITED SYPHILIS.

Infection.—*Father and Mother both Syphilitic.*—It is almost needless to say that, when *both father and mother* are syphilitic at the time of conception, the fœtus will be almost invariably infected. The children suffer from a severe form of syphilis, and usually die.

Mother alone Syphilitic (*Father being Healthy*).—If the mother acquired her syphilis *before* conception the child is almost sure to be infected, as it is nourished directly by the maternal blood containing the syphilitic virus. If the mother is infected with syphilis *after conception,* but during the pregnancy, we have two conditions to consider:—

(*a*) If the mother's infection has occurred in the *early months of pregnancy, before* the independent fœtal circulation has been established, the fœtus is usually infected with syphilis, because the fœtus is nourished *directly* by the maternal blood containing the syphilitic virus.

(*b*) In the later months of pregnancy, however, the fœtus has its own independent circulation. The villi of the placenta are interposed between the fœtal and maternal circulation, and the nutrient material passes from the mother to the fœtus, not by direct interchange of blood, but by *osmosis.*

If the mother acquires syphilis *after* the establishment of an independent fœtal circulation, the villi of the placenta may filter out and prevent the virus from reaching the child; but, as the *antitoxins* are held in solution, they will pass through the membrane of the placental villi and exert an immunizing action upon the fœtus. Hence we have **Profeta's law of immunity**: "Children may be born of syphilitic parents and remain healthy, and present an immunity against syphilis which is either absolute or else modifies the syphilis so that it runs a very mild course."

Father alone Syphilitic (*Mother being Healthy*).—Under this head there are also two conditions to consider:—

(*a*) The spermatozoa may contain the virus and carry it to the ovum at the time of conception, and, as a result, the child is syphilitic. The syphilis may cause the death of the fœtus *in utero,* interference with development, or simple debility, or the child may be born syphilitic.

Infection of the fœtus by the father is the most common form, but the syphilis resulting is less severe than in the other forms of infection, for the reason that if the mother remains healthy the fœtus is nourished with healthy blood and the harmful effects of the syphilis are partly neutralized.

(*b*) The spermatozoa, however, do not always carry the virus of syphilis to the ovule, and the child often escapes infection and is born healthy.

Influence of the Child's Syphilis as Exerted upon the Mother.—We may consider now the instances in which the *mother is free from syphilis,* but the child has been infected by the *father* at the time of conception. The effects which the child's syphilis cause in the mother must be divided into *three groups*:—

(*a*) In the first group, the mother remains entirely unaffected, and a condition of immunity is *not* established, so that the mother may acquire syphilis from her own child after its birth or from other sources. These cases are extremely rare, and prove an exception to the generally established law of Colles.

(*b*) The second group forms a large number of cases, and comprises the instances in which the mother *is* infected with syphilis from her own child, during its term of gestation in the uterus. The name given to this mode of infection of the mother is *choc en retour*, or *syphilis by conception*. The syphilitic virus formed in the child passes over directly into the mother's blood, through the placental circulation.

(*c*) The third group includes the cases in which the mother is *not* infected from the child *in utero*, but becomes *immune against syphilis*, and is described by **Colles's law**, viz.: "A syphilitic child cannot infect its own mother after its birth." The mother acquires immunity against infection, probably from absorption of the antitoxin of syphilis which is formed in the body of the fœtus. It is supposed that the placental villi act as a filter, and allow the antitoxins, which are in a state of solution, to pass through them, by osmosis, into the maternal blood, but prevent the virus from reaching the mother's circulation in any great quantity.

Length of Time After the Chancre at which Infection of the Fœtus or Choc en Retour is Liable to Occur.—Syphilis is most liable to be communicated to the fœtus or by *choc en retour* during the secondary period and the first three or four years after the primary sore. As time passes the intensity of the syphilis also diminishes, as is shown by the following table:—

Termination of Pregnancies in a Syphilitic Mother. — I. First pregnancy terminates in an *abortion*.

II. The next pregnancy results in the premature birth of a syphilitic child.

III. Then follows the birth of a full-term child, which has syphilitic manifestations.

IV. Next a child is born at full term, which subsequently develops manifestations of syphilis.

V. Finally healthy, full-term children are born which remain healthy and free from syphilis.

It is important to bear in mind that the inheritance of syphilis by the child can be favorably influenced or absolutely prevented by treating the syphilis of the parents, both before and after conception, with mercury.

As a result of the observations made in regard to inherited syphilis, the following principles can be applied practically:—

I. A man or woman with syphilis should not be allowed to marry until three or four years have elapsed since the original infection, and methodic treatment should be carried out during this period.

II. If a married man or woman acquire syphilis, he or she should be energetically treated, in order to lesson the danger of infection of the fœtus in case pregnancy should occur.

III. A pregnant woman with syphilis should be energetically treated during the entire period of pregnancy.

IV. If a woman free from syphilis becomes pregnant, by a syphilitic man, she should be treated, to prevent the danger of *choc en retour.*

V. A syphilitic child should only nurse from its mother, and never be allowed to nurse from a wet-nurse.

VI. A child apparently healthy, although born of syphilitic parents, should never be allowed to nurse from a wet-nurse, until at least three months have elapsed without any symptoms of syphilis developing in the child.

SYPHILIS AND MARRIAGE.

The relation which the question of marriage bears to syphilis is an important one. The lesions of tertiary syphilis are not contagious, and in most cases the infectious element has disappeared after the lapse of two years; still it is necessary to bear in mind that a syphilitic father may propagate a diseased child, which may be still-born or infect the mother by *choc en retour,* up to the end of the third or fourth year. On this account a set of working rules might be formulated as follows:—

I. No one showing signs of active syphilis should be allowed to marry, even though more than four years have elapsed since the primary infection.

II. Marriage should never be sanctioned until at least three years have elapsed after infection, provided the patient has been systematically treated during that time: but four years is a safer time-limit, and patients should be advised to wait for that length of time.

III. Marriage should not be permitted until at least one year has passed during which *no* symptoms have appeared.

DIAGNOSIS OF SYPHILIS.

The question of diagnosis is an important one, both from the stand-point of therapeutics and also from the necessity of guarding other persons against a contagious disease. Of course, it is more difficult oftentimes to make a diagnosis many years after infection than when the initial lesion, mucous patches, and eruption are all present. It is always better to conduct the examination in a systematic manner, and begin by taking the **history of the case.**

We should inquire if the patient has suffered from: (*a*) a venereal sore with lumps in the groin; followed by (*b*) a rash upon the skin, (*c*) sore throat or sores in the mouth, (*d*) pains in the bones and skull which were worse at night, (*e*) sore eyes, and (*f*) in women the occurrence of abortion or still-births.

It is important to bear in mind that syphilis is not always acquired by venereal contact, and the initial lesion may not have been on the genital organs. We should also remember that the early manifestations may have been so slight, particularly in women, as not to have been noticed.

It is well to bear in mind that in men there is a possibility of the chancre being located within the urethra, without causing any symptoms except a slight gleety discharge, which might be mistaken for a urethritis. The *glandular enlargement*, which is such a valuable diagnostic sign, disappears after two years and is unavailable.

Late in the tertiary period the diagnosis often presents great difficulties. There are, however, certain **points for examination** which may throw some light on the nature of the case:—

The *skin* and *mucous membranes* should be examined for cicatrices. The *bones* and *testes* may show irregularities or swellings. The *eyes* often show decided changes. Local paralysis of an ocular muscle is a valuable diagnostic sign. Iritic adhesions may be present, or there may be changes in the deeper structures. B. Sachs regards the *action of the pupils* as a very important sign. The changes which occur in syphilitic cases, without previous demonstrable ocular disease, are as follow: I. Inequality of pupils. II. Unequal response to light in one pupil, but not in the other. III. Complete immobility to light and accommodation. IV. Departure from the circular form of the pupil without preceding iritis.

In doubtful cases the diagnosis is sometimes made by the effects of the administration of mercury and iodide of potash. If the lesions improve, it is supposed that they were of syphilitic origin. This is a very uncertain and misleading method of trying to get at the truth, for the reason that mercury and iodide of potash will often cause the absorption of newly-formed inflammatory infiltration, irrespective of its cause. The results of an inflammation which was due to the irritation of any toxic agent in the blood—either uric acid, alcohol, or syphilis—will be absorbed under the use of mercury and iodide, although the infiltration due to syphilis disappears more quickly than the others. (See chapter on "Inherited Syphilis.")

PROGNOSIS OF SYPHILIS.

The danger to life in syphilis in the adult depends upon the involvement of some vital organ by endarteritis or gummatous infiltration, and this frequently occurs years after infection, when the syphilis is supposed to be extinct.

The ultimate recovery of a patient with syphilis depends upon the following factors:—

I. On the systematic thoroughness and length of time which the case is treated.

II. On the constitution of the patient.

III. On the virulence of the poison.

Any cause which tends to depress the general health—such as privation, bad hygienic surroundings, overwork, anxiety, loss of sleep, and particularly habits of alcoholic indulgence—retard recovery.

As in most other diseases, the extremes of life—that is, old persons and young children—bear syphilis badly, and the death-rate, particularly in children, is high.

Women are believed by some German observers to be less severely affected than men, and are thought to be less liable to syphilitic affections of the nervous system.

Among the early prognostic indications it is thought that, when the *glandular enlargement* is slight, the syphilis will run a mild course.

The appearance of tertiary lesions prematurely, and in the early months after infection, is a very unfavorable prognostic sign.

Extragenital chancres—*i.e.*, those which are located on the finger, breast, lip, etc.—are more apt to be followed by a severe attack of syphilis than in the cases where the chancre is located upon the genitals.

CHAPTER XXII.

TREATMENT OF SYPHILIS.

As SYPHILIS is a general and constitutional disease, dependent upon a specific poison, it is necessary to introduce a remedy into the circulation which will cause either an elimination of the poison or else neutralize it and render it inert and harmless. The drugs which are the mainstay in the treatment of syphilis are mercury and iodide of potash.

Mercury is supposed to have a direct action upon the syphilitic virus, destroying and neutralizing it.

Mercury may be introduced into the organism by three routes:—

I. Through the skin: (*a*) by inunction; (*b*) by fumigation.
II. Under the skin by hypodermic injection.
III. Through the intestinal canal.

It is eliminated by the kidneys, intestinal glands, and by the mucous membrane of the mouth and salivary glands.

After a varying quantity of mercury has been given for some time, the blood becomes saturated with it, and this is announced by the occurrence of **mercurial stomatitis,** which is ushered in by certain **prodromal symptoms**:—

(*a*) A coppery taste in the mouth.
(*b*) An increased flow of saliva.
(*c*) Slight pain on striking the teeth together.
(*d*) Slight swelling and sponginess of the gums next the teeth.

In mild cases of ptyalism the symptoms all subside in a few days if the administration of the drug is stopped; but, if an excessive quantity of mercury has been introduced into the body, or if an unusual susceptibility to the action of mercury is present, the toxæmia is indicated by **salivation.**

In severe cases of salivation the gums and buccal mucous membrane are greatly swollen and ulcerated. The teeth loosen and fall out, the saliva pours out from the mouth in quantities, even to the extent of several pints in the day, and the breath has an intensely fœtid odor.

In the administration of mercury in syphilis it is essential to give a sufficient quantity of the drug to produce *ptyalism*, or to "touch the gums," as it is usually called, as this symptom indicates that the patient is getting the requisite quantity of mercury to hold the disease in check. But care should always be taken to stop the mercury before *salivation* is induced.

A bad condition of the mouth and carious broken teeth covered with tartar cause the mouth to react prematurely to the influence of mercury, and for this reason the patient should go to a dentist and have the teeth put in order, before beginning treatment.

Treatment of Salivation.—The fœtor of the breath and the ulceration can be best checked by means of chlorate of potash in solution used as a mouth-wash, and it should also be given internally in doses of 20 grains three times a day. The pain in the gums induced by mastication can be lessened by brushing the gums with a 4-per-cent. cocaine solution before eating, although in severe cases the patient should be fed upon liquid food. The excessive secretion of saliva is controlled, to some extent, by hypodermic injections of atropine.

MODES OF ADMINISTERING MERCURY.

Inunction.—The method of rubbing mercurial ointment into the skin is the most sure and effective mode of treating an ordinary case of syphilis, and is the *only* plan of treatment to use in the presence of grave lesions threatening life or the integrity of vital organs.

The advantage of inunction is its prompt action in saturating the body with mercury, and it is possible to give three times the quantity of mercury in this way which could be given by the mouth. At the same time the stomach digestion is not interfered with, and the patient can assimilate the maximum quantity of food, and his nutrition is maintained.

The mercury, through the friction and pressure of rubbing, is pressed into the open mouths of the sebaceous follicles and sweat-ducts in the skin. It is brought gradually in contact with the blood circulating in the capillaries of the papillary layer in the skin, and is supposed to be converted into bichloride of mercury through combination with the sodium chloride in the blood. In this soluble form it is thought to pass into the general blood-circulation. The mercury is stored up in the follicles of the skin for a long time after the inunctions have been discontinued, and can be found eliminated by the urine many weeks after the last inunction was given.

The blue ointment, or unguentum hydrargyrum, is the best preparation to use, and it is preferable to have it made after the formulary of the German pharmacopœia, which contains 20 grains of metallic mercury in every drachm of lard. In ordinary cases 1 drachm is a suitable dose, but in exceptional cases 2 drachms may be used.

It is well to have the druggist measure out the daily dose of ointment and inclose it in waxed paper. The ointment should be very thoroughly rubbed into the skin, selecting a fresh portion of the surface of the body for each day's rubbing, and it is not practicable for the patient to rub himself, but the inunction should be made by an attendant or *masseur*.

It requires from twenty to thirty minutes' firm rubbing with the uncovered hand to cause the complete absorption of the entire quantity of ointment used.

It is also desirable to make the inunctions in a regular course, as follows:—

First day: In the calves.
Second day: Inner and outer sides of the thigh.
Third day: Chest and abdomen.
Fourth day: Flexor surfaces of arms.
Fifth day: Back.

On the sixth day the patient takes a warm bath with soap, and on the seventh day begins again with another course of rubbings.

It requires from 20 to 50 inunctions, as a rule, to induce ptyalism, and the *gums should be touched in every case before the inunctions are discontinued.* The inunction should be used in both secondary and tertiary periods whenever danger threatens a vital organ, such as the eye, brain, larynx, etc., and also in obstinate ulcerative processes with rapid destruction of tissue. Inunction is also the most reliable means of treating the ordinary mild cases of syphilis.

Fumigations of calomel are a useful *adjunct* to other treatment in the cases of early lesions, which are extensive and have a tendency to involve the deeper structures, ulcerate, and extend. The calomel-fumes come directly in contact with lesions, and the local action of the vapor of mercury facilitates their healing.

Method of Application.—The patient sits on a cane-bottomed chair with a blanket around his neck, falling to the floor and surrounding him in a sort of tent. The head is left uncovered. A tin pan holding boiling water is placed under the chair, and the patient steamed for fifteen minutes. The pan is then withdrawn and 30 grains of calomel are fumigated on a tin stand, over a spirit-lamp placed underneath the chair, and the patient is allowed to remain surrounded by the fumes for half an hour. The fumigation should be employed once a day until the gums are touched.

Sublimate baths are employed in the same class of cases, viz.: extensive, ulcerating, suppurating lesions. The intact skin does not permit a trace of sublimate in solution to be absorbed, but absorption can take place through solutions of continuity.

Intramuscular Injections.—The former practice of injecting *corrosive sublimate in solution* under the skin has been practically abandoned; its place is taken by the insoluble salts: calomel and salicylate of mercury, held in emulsion and injected deep into the substance of the gluteal muscles. An ordinary hypodermic syringe is used, provided with a needle which is two inches long and with a thick bore. In ordinary cases the injection is made once a week, and, in general, the salicylate of mercury is to be preferred to the calomel. Formula:—

℞ Hydrargyri salicylatis	gr. xxiij.
Lanolini	gr. xv.
Oleum olivæ	*m*ccxviij.

M. Sig.: Inject fifteen minims hypodermically once a week. Fifteen minims contain gr. iss of the salicylate of mercury.

The *advantages* of intramuscular injections are that they act promptly and rapidly, and are almost, if not quite, as efficacious as inunctions. The dosage is accurate, and the injection is only made once a week, so that the patient is relieved from the annoyance of taking medicine or making inunctions in the intervals.

The *disadvantages* are the *pain*, which is very inconsiderable, and the slight chance of the occurrence of abscess, which seldom happens.

In exceptional cases the oil has been known to form a *pulmonary embolus*, with a localized pneumonia, but recovery followed in each case.

Salivation may occur in a small proportion of cases, without any previous warning, and, as the deposit of mercury is in the muscle, we cannot stop its absorption unless an incision is made into the muscle and the small mass of mercury removed by a curette.

Administration of Mercury by Mouth.—While in Germany the usual method of administering mercury is by inunction, in this country it is the custom to treat syphilis by its internal administration.

In recent times, however, we are coming to the conclusion that it is not enough to rely wholly upon giving mercury by the mouth, but that its action should be supplemented by regular courses of inunction at different times, during the progress of the disease, in order to attain a cure of the syphilis.

If mercury is given by the mouth, after a certain length of time, the absorptive powers of the intestinal canal often become impaired, and the mercury passes through the alimentary tract unchanged, and without being absorbed. Its continuous use for a long period of time often causes anæmia, emaciation, and diarrhœa.

The internal administration of mercury is appropriate during the intervals of inunction and in the periods of latency of syphilis, but it should never be depended upon in severe cases or grave complications. These require the mercury to be given by inunction or hypodermic injection.

Preparations of Mercury.—*Pills of protiodide of mercury* (Lamoureux & Garnier), $^1/_5$ grain each.

Method of Administration.—One pill is given three times a day after eating, and every third day the dosage is increased by one pill. For example, the patient takes 3 pills for 3 days, and on the 4th day he takes 4 pills, and on the 8th day the dose is increased to 5 pills, and so on up to the *point of tolerance,* which is usually from 10 to 15 pills or more.

The point of tolerance is not manifested by ptyalism, except in rare instances, but by *diarrhœa* and *cramps.* When these symptoms occur, the dosage is reduced to a point just short of producing cramps.

According to the recommendation of Keyes, the full dosage is continued until a *period of latency* occurs, when it is reduced to one-half the number of pills and continued. If a *relapse* takes place, the maximum dose is given again.

Another plan of treatment, which is more to be commended, is to ascertain the maximum dose by gradually increasing the number of pills, and, after the maximum dose is reached, it is maintained, without reduction, throughout the whole course of the disease, unless anæmia, emaciation, diarrhœa, or salivation are produced by it.

Mercury with Chalk (Hydrargyrum cum Creta).—This is a mild preparation, and is not apt to induce colic, and for that reason it may be given when the protiodide produces too much diarrhœa. The method of administration is similar to that of the protiodide. It may be given in 1-grain pills and increased to the *point of tolerance*, which is manifested by either ptyalism or diarrhœa.

Bichloride of Mercury.—Dose, $^1/_{30}$ to $^1/_{15}$ grain. This form of mercury is very useful, and is of particular value, given in combination with iodide of potash, later in the disease in the form of the so-called mixed treatment.

Tannate of Mercury.—Dose, $^1/_2$ to 1 grain three times a day. This is one of the newer preparations, and it is said to have the advantage of causing very little irritation to the intestinal canal.

Iodide of Potash.—The iodide of potash has no direct action in destroying the virus of syphilis, and consequently it is of no use early in the disease. Its action is to cause the absorption of the new growth infiltrating the arteries and which, when it occurs in other tissues, is known as the gumma. The iodide in small doses acts as a tonic, and increases appetite, nutrition, and tissue-change.

The unpleasant effects which are induced by iodide of potash are *coryza* and *lachrymation*, and an *eruption* upon the skin, which usually occurs upon the back, chest, and face as small acneiform pustules. In rare cases large *bullæ* may form or the eruption may be *hæmorrhagic* in character and resemble purpura.

In addition, there is often a condition of anæmia, weakness, and general malaise induced. These symptoms are all less apt to occur if the kidneys secrete freely and the iodide is rapidly eliminated.

Dose and Administration.—The only rule for the size of the dose is the effect produced upon the lesion. For the ordinary routine treatment, during a period of latency, 30 or 40 grains a day are enough, but, in the presence of a grave lesion of the nervous system or viscera, $^1/_2$ ounce or even 1 ounce in the day may be required to save life.

Iodide of potash is best given in saturated solution, 1 minim of distilled water representing 1 grain of the salt. It should be given largely diluted with water, and preferably two hours after a meal, as the iodide combines with the starch in the stomach and forms iodide of starch, which is inert.

When the drug disagrees with the stomach and disturbs the digestion, it may be given in milk, which is coagulated with essence of pepsine, or the patient may be directed to drink one or two glasses of hot water immediately after taking the iodide.

Zittmann's Decoction.—This is one of the official preparations of the pharmacopœia, and is composed of a number of vegetable bitters together with a minute quantity of metallic mercury. Its action is first purgative and later tonic, and in some way, which is not understood, it exercises a most beneficial effect in indolent, spreading ulcerations which do not respond to mercury and iodide of potash. These lesions chiefly occur in malignant syphilis affecting persons of feeble vitality, who are usually of the tubercular diathesis and who cannot tolerate mercury or iodide of potash in any considerable quantities.

The hot springs of Arkansas and Aachen in Germany are useful in the same class of cases, viz.: inveterate syphilis occurring in feeble individuals whose susceptibility to mercury and iodides is so extreme that they cannot be administered in sufficient doses to hold the disease under control. The water of these springs contains very little mineral substance, but has a temperature of 140° F. as it issues from the earth. Its action is to cause free secretion by the kidneys and skin, and, while it has no specific action upon the lesions of syphilis, it increases the *tolerance* of the body and enables the patient to take large doses of mercury and the iodides.

THERAPEUTICS OF SYPHILIS.

TREATMENT OF DIFFERENT STAGES.

Primary Stage.—It is now generally held by the best authorities that it is not good practice to begin the administration of mercury in syphilis until the eruption appears upon the skin, announcing the commencement of the secondary stage. If mercury is given before this time, it has only the effect of delaying the appearance of the rash, and it may be postponed for some months, but the premature administration of mercury has no effect in aborting the disease or mitigating its severity. On the other hand, it has been noted by Ehrmann that patients who were treated with mercury for some time previous to the appearance of the eruption were more liable to tertiary affections than in the cases where treatment was not begun until the secondary period.

Another advantage which is derived from waiting till secondary manifestations appear, before beginning treatment, is that the diagnosis is fully established and the patient, being entirely convinced that he has syphilis, is more willing to carry out faithfully the details of a protracted course of treatment.

The period of waiting for secondary manifestations can be utilized by sending the patient to a dentist to have the teeth put in order. He should also be instructed as to the **hygiene** to be maintained during the course of the disease. Everything should be done to maintain the bodily health and nutrition; plenty of sleep and exercise in the open air, abundance of plain nutritious food, and freedom from overwork or anxiety should be insisted upon.

The use of tobacco should be interdicted, as it causes an irritation to the mucous membrane of the mouth, which predisposes to the formation of mucous patches and chronic ulceration and tends to retard their healing.

Alcoholic drinks in strict moderation may be permitted in the shape of small quantities of beer or light wine, taken preferably with the meals. The habitual use of whisky is injurious.

The patient should be instructed with regard to the danger of communicating syphilis to others, through the medium of a cup, spoon, pipe, towel, or other utensil, or by means of sexual intercourse or kissing.

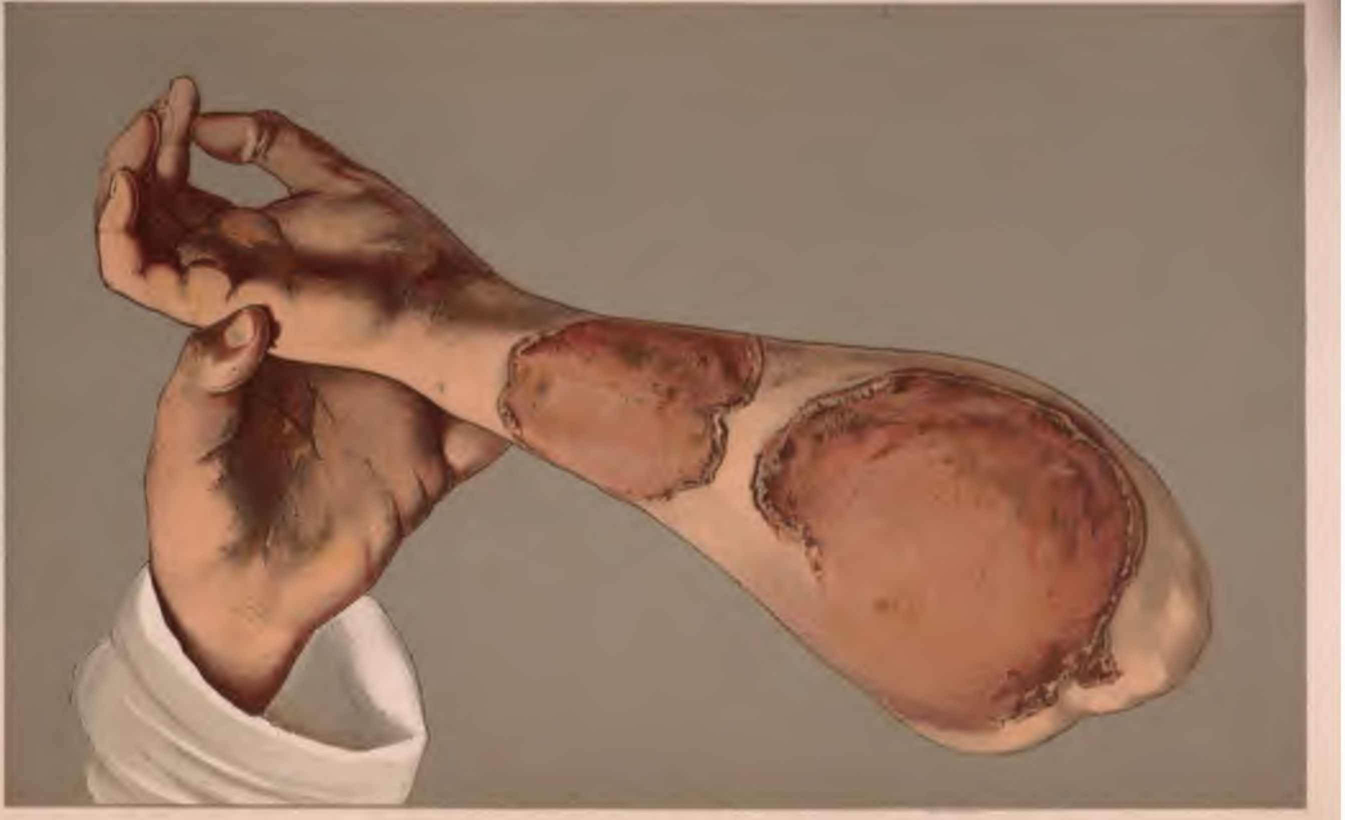
Mild Form of Syphilis.—As the virus of syphilis is being constantly formed and is present in the blood for months, it is necessary, in order to neutralize its effects, to keep the patient continually under the influence of mercury.

Before beginning treatment we should wait until the eruption is well out upon the body, and, as the virus is most abundant in the early stages of the disease, it is always desirable to push the administration of the mercury at first.

A sufficient number of courses of mercurial inunctions should be given to touch the gums, and the drug should then be stopped for a time until the ptyalism has disappeared. During the following six months mercury should be administered by the mouth, and, as a rule, the protiodide pill answers the purpose better than any of the other preparations, as it does not disagree with the stomach.

In many cases, however, after a time the intestinal canal loses its power of absorption, and the mercury is eliminated with the fæces without having passed through the blood. On this account it is always desirable to stop the internal administration of mercury, after six or eight months, in order to allow the intestinal tract to rest, and during the interim several courses of inunctions should be made.

At the end of the first twelve months, unless some indication appears for it earlier, the administration of **iodide of potash** is begun,



DRY OR ATROPHIC TUBERCULAR SYPHILIDE (Author's case from King's County Hospital).

and the mercury is continued in addition. A favorite and useful prescription which, although chemically incompatible, is therapeutically active, is the following for the so-called mixed treatment:—

℞	Hydrargyri bichloridi	gr. ij.
	Potassii iodidi	ʒv.
	Syrupus sarsaparillæ	f℥ij.
	Aquæ destillatæ	q. s. ad f℥iv.

M. Sig.: ʒj t. i. d.

The iodide of potash has no direct action on the virus of syphilis, but it stimulates the activity of the lymphatic system, facilitates getting rid of waste-products, and also causes the absorption of any syphilitic infiltration which may have taken place in the tissues or arteries.

The iodide of potash and mercury should be continued together with an intermission every six months, during which courses of inunctions should be made. At the end of two and one-half years' treatment the patient having been on mercury alone for twelve months and mercury and iodide of potash together eighteen months longer, the medication may be stopped.

The patient should be then kept under observation six months more, and, if no relapses occur, the syphilis may be considered at an end.

The general nutrition of the patient should receive the closest attention during this protracted treatment. Syphilis itself is a debilitating disease, and mercury, if administered for a long time, has the effect of causing a condition of pallor and anæmia. Of course, when such an effect is induced, the mercury should be stopped and tonics given.

Tonics are usually required at some stage in the disease, to counteract the destruction of red corpuscles caused by the virus. The anæmia is treated with iron, and the nervous system and general nutrition are stimulated with strychnia. Codliver-oil is very valuable for the emaciation and loss of weight, and especially so if there is a complication of tuberculosis. Close attention should also be paid to the matters of fresh air, exercise, food, sleep, and freedom from anxiety.

Severe Form of Syphilis.—The severe cases of syphilis and malignant syphilis cannot be treated in any routine way, but each case must be handled with reference to its own peculiarities. We can say, in a general way, that it is necessary to get the patient promptly under the influence of mercury and at the same time avoid disturbing the digestion, and the hygienic treatment—consisting in good food, good hygienic surroundings, sunlight, fresh air, and tonics—is imperatively demanded in these cases.

The best method of using mercury is by inunction, and next in value may be ranked the hypodermic injections. The disadvantages of giving mercury by the mouth are that it acts more slowly and is very apt to disturb the digestion. After the disease is under control the mercury may be given by the mouth, but inunctions should be used a couple of times a year.

In this class of cases it is necessary to begin the administration of *iodide of potash* earlier than at the beginning of the second year, inasmuch as tertiary lesions or gummata are apt to occur precociously, even as early as the fifth or six month, and the iodide generally has to be used in larger doses.

After the syphilis has run a severe course for a few months a condition is induced which is known as the **cachexia of syphilis**, and which is characterized by extreme debility and vital depression, which have resulted in consequence of the anæmia and emaciation.

If severe spreading lesions exist upon the skin and mucous membranes, the case may be properly termed *malignant syphilis*. These patients unfortunately do not bear mercury and the iodide well, and in these conditions such tonic remedies as Zittmann's decoction and the hot springs of Arkansas are to be recommended.

Grave tertiary lesions of the viscera or nervous system are liable to follow a mild attack as well as a severe one, and, of course, the outlook for ultimate recovery depends largely upon the general character of the patient's constitution.

With individuals of fair bodily health, in the presence of a gumma of the brain or viscera, or of endarteritis of the arteries supplying the nervous system, or, indeed, any of the manifold complications of the tertiary period, the mercury should be given by inunction and iodide of potash in saturated solution. The dosage of the iodide should be increased rapidly up to $^1/_2$ ounce or even 1 ounce in the day, the only rule for the quantity given being the effect produced.

LOCAL TREATMENT OF LESIONS.

It has been found that the direct contact of a mercurial preparation with a local syphilitic lesion hastens its disappearance by absorption. An advantage is sometimes taken of this fact by using fumigation or bichloride baths, in addition to the regular general treatment, to accelerate the healing of extensive, wide-spread, ulcerating lesions of the skin.

The papular eruptions on the face are annoying and unsightly, and can be made to clear up more quickly by rubbing in one of the following ointments:—

Oleate of mercury, 5 per cent.
White-precipitate ointment.
Mercurial plaster.

Mucous Patches.—If mucous patches exist in the mouth, they are always of danger to innocent people, since their secretions may be conveyed upon some utensil and be inoculated into another person. On this account we should endeavor to heal them as quickly as possible. In addition to the frequent use, by the patient, of a mouth-wash of chlorate of potash or calomel and lime-water, the patches themselves should be touched every three or four days with nitrate of silver in stick, or glycerin and carbolic acid in equal parts, bichloride of mercury in alcohol (1 in 20), or the acid nitrate of mercury.

Condylomata heal readily under the general mercurial treatment, and it is only necessary to keep them clean; cover them with a dusting-powder, which absorbs their secretions; and prevent contact with other parts and chafing by means of absorbent cotton interposed.

CHAPTER XXIII.

INHERITED SYPHILIS.

As ALREADY stated in the last chapter, the parental syphilis exerts a bad effect upon the fœtus, unless a degree of immunity has been induced. In its most active stages the effect of the poison is to cause the termination of the pregnancy in an abortion; that, as the syphilis grows older its virulence lessens, so that the next child is probably still-born, and the following one may be born alive, but with the syphilitic taint.

Children which are still-born are usually retained long enough in the uterus, after death, to become macerated. The epidermis is stripped off or raised up into large bullæ. The liquor amnii is discolored, brown, and foul-smelling. On examination of the infant's viscera, upon the autopsy-table, they are found to be the seat of the characteristic changes of syphilis.

Occasionally children are born of syphilitic parents who have all the manifestations of a florid syphilis upon them, but usually one or two weeks pass before the syphilis becomes visible. In appearance these children are usually ill developed, small, and of light weight. The skin is faded, and they look like little, shriveled, old men.

If the parental syphilis is still older, the children may be born apparently healthy, and develop syphilitic manifestations later. The most common time for their appearance is within the first three months after birth and rarely later than the first six months.

Although children born of syphilitic parents may escape the inheritance of an active form of syphilis by reason of a certain acquired immunity, they may receive a **diathetic taint,** which does not make itself evident by any characteristic manifestations. These children have a feeble constitution, and suffer from a general want of mental and bodily development which is particularly notable at the time of puberty.

The children develop slowly, remain small, and are thin and anæmic and without the power of resistance against accidental disease. The intelligence is often deficient, and such instances are described as cases of **late hereditary syphilis.**

COURSE.

The course of inherited syphilis resembles that of the acquired disease, except that it does not begin from a chancre and that the lesions peculiar to the secondary and tertiary periods appear simultaneously.

When a child is born apparently well, but develops syphilis later, one of the most striking symptoms of the impending outbreak is the nasal catarrh, causing **snuffles.** This is soon followed by an affection of the mucous membrane of the mouth and larynx, which causes a **hoarse cry.** Mucous patches occur about the skin of the mouth, which interfere with the child's nursing, and the nutrition suffers.

The **eruptions upon the skin** resemble those of acquired syphilis. A *macular eruption* often occurs upon the chest, and a *diffused erythematous redness,* resembling eczema in outward appearances, is often seen about the mouth and navel and parts where the skin is liable to chafe against another opposing surface, such as in the groins, axillæ, or nates.

If the patient is not treated, and in severe cases, the eruption develops into *papules.* The soles of the feet and palms of the hands become the seat of copper-colored papules, which desquamate and are changed into deep *fissures.* The papules located about the mouth, anus, and genitals are apt to become transformed into luxuriant and vegetating **condylomata.**

An eruption which is unique, inasmuch as it does not occur in adults, but only in children, is *syphilitic pemphigus,* in which large *bullæ,* or blebs, form on the palms and soles, although it sometimes occurs over the entire body. Its formation is explained by the delicate character of the epidermis and the readiness with which serum collects underneath it and raises it from the derma, forming a vesicle, or bulla.

All the above-mentioned eruptions may exist at the same time, and the symptom of *polymorphism* is usually more marked in inherited than in acquired syphilis.

The viscera are affected in inherited syphilis even more frequently than in the acquired form. The *liver* is often the seat of a form of *cirrhosis* occasioned by its infiltration with newly-formed connective tissue, or *gummata* may exist in various portions of the gland. The *pancreas* is affected in a similar way. The *lungs* may be the site of gummata, and, as a consequence of periarteritis, the frame-work of the alveoli becomes infiltrated with new cells in various areas, causing *white hepatization.*

A very characteristic feature of inherited syphilis is **osteochondritis**, which is considered by some authorities as pathognomonic. It consists in an overgrowth of the cartilage which is interposed between the epiphyses and the diaphyses of the long bones and skull. By palpation the enlarged cartilage can be felt surrounding the bone like a collar. The ultimate course of the inflammation may end in suppuration and necrosis, and, after extrusion of the dead bone, the injury is repaired by the abundant formation of new bony tissue, causing an **osteophyte.** Osteophytes occurring upon the skull give a peculiar "squared" shape to it.

The inflammation involving the cartilages often travels to the **joints,** and a serous or purulent synovitis occurs. **The teeth** of the second set are deformed by a vertical notching and peg shape of the central incisors.

The nervous system suffers as well, and epileptiform convulsions, tabes, and progressive paralysis are frequently seen in syphilitic children.

Hæmorrhagic syphilis exists at birth or else makes its appearance within the first month. It is a condition in which the blood is effused under the skin or mucous membranes, forming large purpuric spots. It is not infrequently met with, and is due to the endarteritis, which permits the escape of blood in greater or less quantities.

RECOGNITION OF INHERITED TAINT.

There are certain points which are of use in making a diagnosis of inherited syphilis at an age advanced from infancy. The most reliable sign is the presence of **Hutchinson's teeth.** The central upper incisors of the second set are the most characteristically affected. The deformity consists in the *peg shape of the teeth* and the *vertical notching in their lower edges.* Jonathan Hutchinson considers them pathognomonic of inherited syphilis, and describes them as follows: "The central incisors are short and narrow, with a broad vertical notch on their edges and their corners rounded off. Horizontal notches or furrows are often seen, but, as a rule, have nothing to do with syphilis."

In the subjects of inherited syphilis the *skin* is thick, pasty, and opaque, or occasionally remarkably soft and silky. At the angles of the mouth may sometimes be noticed *linear scars,* radiating out into the cheeks. The *bridge of the nose* is usually broad and low, and a

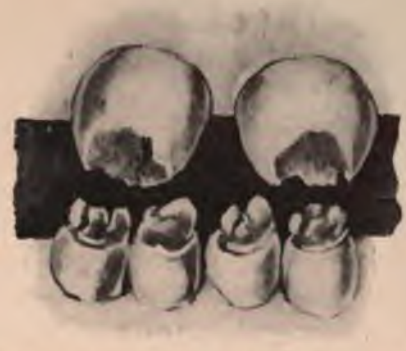


Fig. 94.—Hutchinson's Teeth. These Teeth have been recently cut, and the Central Notch is well outlined, but the thin and unprotected dentine has not yet crumbled away.

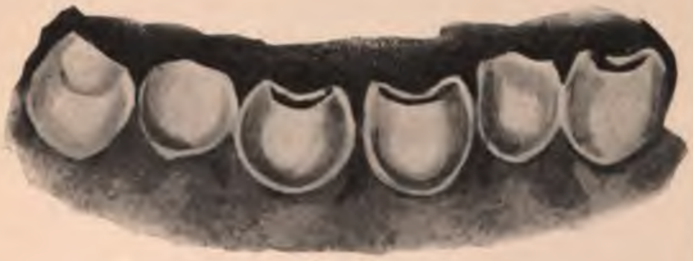


Fig. 95.

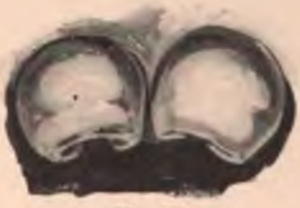


Fig. 96.

Figs. 95 and 96 Show Later Stages of the Process after the Dentine has been destroyed. The characteristic Peg shape, with the vertical Central Notch, is clearly shown.

want of firmness in the cartilaginous septum, which allows the nose to be shaken about too easily, is sometimes observed.

The *eyes* are liable to be affected, and the occurrence of a well-marked **interstitial keratitis** is regarded as *pathognomonic* of inherited syphilis. The *skull* is apt to be squared in shape and to show low protuberances in various parts. The *long bones* are often the seat of periosteal thickenings or nodes, and the phalanges and neighboring joints may be affected by a globular swelling, a form of periostitis or ostitis, to which the name *dactylitis* is given.

The *ears* are occasionally affected, and symmetrical deafness, which has occurred without discharge from the ears, is said to be strong corroborative evidence of an inherited taint.

TREATMENT.

It has been thought possible to treat an infant, affected with syphilis, by giving mercury to the mother, and allowing the child to nurse from her breast. It was supposed that enough mercury would be eliminated in the milk to control the syphilis of the child. The quantity, however, eliminated in the milk is too small to be of very much avail, and we are obliged to give specific treatment in other ways.

With children, as in the case of adults, **inunctions** are the most useful way of giving mercury, as in this way the digestion is not interfered with.

It is not necessary to rub the ointment all over the body, as in adults, but 30 grains of mercurial ointment, mixed with an equal quantity of lanolin to assist absorption, may be spread on the child's binder, which surrounds the abdomen, and allowed to remain in contact with the skin for two or three days. At the end of that time the ointment may be renewed.

If too much irritation is caused and an eczema follows, the inunctions must be suspended and the drug given by the *mouth*. Various preparations of mercury may be used in this way.

Among those most highly recommended are the following:—

℞ Hydrargyri cum cretæ.................................... gr. i-vj.
Sacchari albi.. gr. xij.

M. et div. in chartulas xij.
Sig.: One t. i. d.

℞ Calomel .... gr. $^{1}/_{6}$-$^{1}/_{2}$.
Sig.: Three times a day.

℞ Bichloride of mercury.................................. gr. 1/[illegible]-1/[illegible].
Sig.: Three times a day.

As we have already found, in infantile syphilis the division into secondary and tertiary periods is not clearly defined, and the lesions peculiar to both periods often exist at the same time. On this account **iodide of potash** is often called for by the appearance of tertiary lesions at an early date in the course of the disease. Iodide of potash may be given in doses of gr. j three times a day, or it may be necessary to give it in much larger doses, if the lesions are severe.

It is eminently desirable to maintain the nutrition of a syphilitic child, and this can best be accomplished by allowing it to nurse from its own mother. The various forms of artificial feeding are less useful, and should only be resorted to when the mother's milk is insufficient.

Duration of Treatment.—No definite rules can be laid down for the length of time required for the treatment. It is considered best to continue for at least two years, with occasional intermissions, but treatment should only be stopped after all manifestations have ceased.

IMPOTENCE AND STERILITY.

CHAPTER XXIV.

IMPOTENCE.

IMPOTENCE may be defined as an inability on the part of the male to copulate, either on account of a failure of the penis to become erect or because the ejaculation of seminal fluid takes place prematurely and before the penis has entered the vagina or else does not occur at all.

The mechanism of copulation is a complicated one, and requires for its performance the co-ordinated working of both nervous and muscular systems. The function of erection is known to be under the control of a collection of nervous ganglia situated in the lumbar enlargement of the spinal cord, which is called the **centre** of **erection.** The centre of erection receives nerve-filaments from the genital centre in the brain, and it also receives sensory fibres from the rectum, bladder, and genitals. It also sends out nerves, the *nervi erigentes*, to the genitals, whose function is to cause a vasomotor paresis of the blood-vessels in the corpora cavernosa.

A knowledge of the distribution of these various nerves serves to explain the following facts: An erection may be provoked by the influence of the brain, if it entertains libidinous ideas, or an *inhibitory influence* may be exerted from the brain by the mental emotions of fear, disgust, or fright (psychical impotence), and vigorous mental activity has the effect of removing, for the time being, sexual desire.

Certain forms of irritation of the spinal cord, caused by myelitis, traumatism, or fracture-dislocation, when the lesion is located in the cervical or upper dorsal region, are often attended with persistent and powerful erections of the penis.

Erections are also caused by peripheral irritation from the genitals, transmitted along the nerves leading to the centre of erection in the cord. At this point, as a result of irritation of the genitals, the sensory impulse is converted into a motor one and reflected back again to the genitals along the *nervi erigentes*.

As common illustrations of erections from peripheral irritation may be mentioned the erections occasioned by a bladder filled with urine in the morning, prostatic enlargement, or the passage of a sound through the deep urethra.

MECHANISM OF ERECTION.

The mechanism of erection is as follows: Under the influence of the nervi erigentes a relaxation of the vascular spaces in the corpora cavernosa takes place, and they fill with blood. The penis becomes erect, hard, and elongated, because the blood is pumped into the spaces and retained there.

If the blood flowed out of the erectile tissue as fast as it came in, erection could not occur, but the swelling of the corpora cavernosa exerts a certain degree of pressure upon the veins which ordinarily conduct the outflowing blood away from the penis. The return-flow of blood is checked by the pressure on the veins, and it is retained in the spaces of the erectile tissue of the penis.

Unless the spaces of the erectile tissue be completely relaxed, a sufficient quantity of blood cannot enter them to exert pressure on the outgoing veins, and the blood flows away through them.

MECHANISM OF EJACULATION.

In a normal condition ejaculation only occurs with a fully erect penis, except during sleep.

As the spaces of the corpora cavernosa become filled with blood, the verumontanum, or caput gallinaginis, which is composed of erectile tissue, also swells and becomes erect, thus blocking the entrance to the bladder, so that urine cannot flow out.

The urethral glands secrete freely and a viscid clear drop of mucus appears at the orifice of the urethra. The object of the secretion is to cover the urethral walls bathed in acid urine and to prepare them for the reception of the semen.

The contents of the seminal vesicles are poured out through the ejaculatory ducts until the posterior and bulbous dilatations of the urethra become filled with semen, and after these are distended contractions of the bulbo-cavernosus muscles occur, and the semen is ejaculated in jets from the meatus. If the force of the muscles is impaired, as in paralytic impotence, the semen is not shot out in jets, but dribbles slowly away from the meatus.

CLASSIFICATION OF FORMS OF IMPOTENCE.

I. Organic, from mechanical defects.

II. Psychical, or imaginary: 1. Complete. 2. Relative.

III. Atonic, from exhaustion of genital centres in brain and spinal cord.

IV. Symptomatic: Variety A. Irritable Impotence, from disease in urethra or adnexa. Variety B. Paralytic Impotence, from organic disease in nervous system. Variety C. Impotence due to Drugs.

ORGANIC IMPOTENCE.

In this form of impotence some physical cause, which is either congenital or acquired, renders coitus mechanically impossible. The obstacle may prevent the introduction of the penis into the vagina, or, in the absence of a urethra while coitus can be performed, it is not possible to inject the semen into the vagina.

Among the causes of organic impotence may be mentioned such failures of development as hypospadias, epispadias, small size of the organ, or acquired deformities (such as elephantiasis and tumors), disease of the corpora cavernosa (such as syphilitic or fibroid induration), or partial destruction following wounds, and cavernitis are sometimes responsible for interference with coitus, and operate by causing a deviation or curve in the penis upon erection.

Swellings of the surrounding parts, such as hernia, scrotal tumors, or excessive corpulence, with an overhanging belly, may render insertion of the penis impossible, but the sexual desire is strong, and ejaculation occurs.

TREATMENT.

In organic impotence the treatment will be successful in so far as it is possible to remove the mechanical obstacle to copulation.

In hypospadias and epispadias a plastic operation can be performed, and, when the penis is completely inclosed by overlying tissues, a small, freely-movable penis capable of intromission may be formed.

Tumors and elephantiasic growths must be removed by surgical means, and hernia and hydrocele also call for operation. An effort should be made to bring about absorption of the infiltration in the corpus spongiosum, which may be confidently expected to occur if it is syphilitic in origin.

PSYCHICAL IMPOTENCE.

We have already noted in studying the physiology of coitus, the fact that the brain is capable of exerting a restraining influence over the power of erection, through the inhibitory nerves which go to the spinal centre of erection. As a result of nervous excitement, the action of the inhibitory nerves from the brain is aggravated, and erection fails at the critical moment. The influence of fear and dread are observed in the same class of patients before passing a sound.

When these individuals are lying on the table, the penis is seen to shrink and grow smaller and move in a worm-like manner, which is caused by the spasmodic contraction of the muscular fibres imbedded in the trabeculæ of the corpora cavernosa. In such cases the inhibitory nerves are stimulated by the dread of catheterism, and in the same way other psychical influences stimulate the action of the inhibitory nerves, and the patient is at such moments impotent.

Various types of men are affected by the form of psychical, or imaginary, impotence, as follows:—

Class A.—A few strong, young, vigorous men who have lead clean lives, on being married to the women of their choice, either from a state of nervous excitement or a lack of confidence in themselves or perhaps occasionally from timidity and bashfulness, do not succeed in holding an erection long enough to perform coitus, and the erection either fails to be complete or else ejaculation occurs prematurely.

Class B.—Feeble, despondent, oversensitive individuals of weak nervous fibre, who have masturbated, had an attack of gonorrhœa, or have been excessive in sexual intercourse. Such persons are continually dwelling on past abuse and worrying over trifling symptoms, such as a varicocele or the normal weekly occurrence of a seminal emission, and their fears are aggravated by reading quack books.

Class C.—Men of good health and well-balanced minds may be affected by various mental emotions, such as fear, disgust, and loathing, or the departure from regular habit, all of which may induce temporary impotence.

It is no uncommon experience, when illicit intercourse is being attempted, that a fear of exposure or infection or of disgust at some coarse remark on the part of the woman causes a failure or sudden subsidence of the erection.

The effect of habit is seen in the cases where a man is accustomed to cohabit successfully with one woman, but fails to accomplish the act of coitus with a stranger, until he becomes accustomed to the new fields. Roubaud's case is cited as an example of this. A young man who was accustomed from the beginning of his sexual life to a certain type of woman, who was a blonde and always met him dressed in a silk gown and with shoes on, could never have coitus with any other woman, unless she were also a blonde and dressed in a similar manner.

Severe and prolonged mental strain, such as occurs with students and business and professional men, sometimes brings about a condition of general neurasthenia, one of the symptoms of which is temporary impotence.

Relative impotence is a form of psychical impotence, and is the term applied to a condition in which the man is able to copulate with certain women only, and not with others.

When this is the case between man and wife, it may be due to a mutual aversion or a lack of sexual feeling on the part of the wife, which reacts upon the man and takes away his desire, and yet the same man may be entirely potent with other women.

TREATMENT.

Before beginning treatment, it is essential to make sure that we are dealing with a case of true psychical impotence and that the impotence is not *symptomatic* of some lesion in the urethra or nervous system.

The psychical form disappears spontaneously when the mental disturbances occasioning it vanish. For instance, the death of a beloved wife or loss of fortune and business anxieties may cause temporary impotence, which disappears as time goes by or the individual's circumstances improve. In these cases the friendly advice of a physician in whom the patient has confidence is valuable.

The largest number of cases of psychical impotence occur in nervous young men who have had gonorrhœa or masturbated freely, and who have read and pondered over the false and lurid accounts in quack medical advertisements, pretending to describe the evil consequences of masturbation or sexual excesses.

ATONIC IMPOTENCE.

The term atonic impotence has been rather loosely used by authors, and has been incorrectly made to include cases which were dependent upon lesions of the urethra or spinal cord or the abuse of drugs, and should have been properly classed under the head of symptomatic impotence.

Atonic impotence is a variety of comparatively rare occurrence, and in which there is no demonstrable lesion of the nervous system or urethra. It is purely functional in character, and is dependent entirely upon a failure of the spinal centre of erection, and perhaps the genital centre in the brain, to respond to ordinary stimuli and cause the penis to become erect.

It should be borne in mind, however, that a condition of exhaustion of the nerve-centres is often complicated by chronic inflammatory changes in the posterior urethra, induced by a gonorrhœa of long standing or sexual abuses, and this fact should not be lost sight of in carrying out the treatment. Here, again, advice and the assurances of the physician, in combination with attention to building up the general health by salt-water bathing, out-of-door exercise, boating, golf, and moderate walking or light gymnastic exercises is the basis of treatment.

Hypnotism may be successful in relieving this form of impotence, but, as our knowledge of influencing the mental powers in this way becomes more extended, the danger of inducing the hypnotic state and other drawbacks becomes more obvious; so that, in general, it is not desirable to employ this form of treatment.

In atonic impotence sexual desire is often present, but frequently it is absent, and, as a rule, erections do not occur at all. Sometimes, however, in mild cases, a partial erection, accompanied by premature ejaculation of semen, takes place.

The atonic form of impotence is exclusively found in married men who have practiced coitus excessively or "withdrawal" with their wives for years, excessive masturbators, and old *roués* whose only thought in life has been the gratification of their sexual desires.

The lack of erectile power is usually only one symptom of general neurasthenia, which is accompanied by its usual signs, viz.: mental symptoms such as impairment of memory, fullness in the head, and anxiety; pains in the back and limbs, feeble heart-action, vasomotor disturbances, indigestion, constipation, etc.

These general symptoms have been described by quacks in terrifying terms, in pamphlets pretending to set forth the "evil effects of self-abuse," which have an extensive circulation among the laity.

Authorities are now generally agreed that, aside from a degradation of the moral character of the individual, masturbation, practiced occasionally, exercises but little bad effect upon the general health, and its effects cease as soon as the habit is stopped, unless a condition of chronic inflammation is induced in the posterior urethra, and the same is true of *coitus reservatus*, or withdrawal.

If, however, masturbation or withdrawal is practiced at frequent intervals and for a long period of time, chronic posterior urethritis occurs, which gives rise to various local symptoms and is often complicated by a general neurasthenic state (see "Chronic Posterior Urethritis").

DIAGNOSIS AND TREATMENT.

Before making a diagnosis of atonic impotence care should be taken to exclude any disease of the urethra and its adnexa or the nervous system. It is generally the case that, with old rounders and masturbators, a stricture, chronic urethritis, prostatitis, seminal vesiculitis, or beginning spinal disease is present, and the impotence is not atonic and caused by exhaustion of the nervous centres, but is secondary to and a symptom of the local structural change in urethra or spinal cord.

When all these local conditions have been excluded, however, and we are certain that we are dealing with a pure functional neurosis, the following lines of treatment may be employed:—

The indications are to build up the general health of the patient, and at the same time give complete rest to the genital centres in the brain and cord; so that their cells may have an opportunity to store up again a renewed quantity of nervous energy.

Later on, after a sufficiently long period of rest has been enjoyed, a plan of treatment should be adopted calculated to stimulate and arouse again to activity the dormant cells in the genital centres; but this should never be attempted until a sufficient period of complete repose has been afforded them.

The neurasthenia, which is usually present, requires the first attention, and the patient should be directed to make use of a light, easily-assimilated diet, get plenty of sleep, and take gentle, regular exercise in the open air.

Riding on horseback and the bicycle is not to be recommended, on account of the jarring to which the perineum is subjected when these are indulged in. Sea-bathing has an excellent effect as a general tonic.

Especial stress should be laid upon the necessity for avoiding all sources of erotic excitement, such as lewd books, conversation, and theatrical displays; companionship of women, immoral or otherwise, and all attempts at sexual intercourse must be rigorously interdicted.

In the early stages of treatment, in addition to blood- and tissue-building tonics,—such as codliver-oil and iron,—the spinal sedatives—bromide of potash and lupulin—are in order for the purpose of giving the necessary rest to the exhausted centres.

After this treatment has been continued for some weeks and the patient's neurasthenia has disappeared, it sometimes happens that his sexual functions are improved as well; but frequently the irritability of the genital centre is still so exhausted that erections either do not occur at all or are not sufficiently vigorous, and ejaculation is premature; so that a special stimulating plan of treatment has to be adopted to arouse the activity of the cells in the genital centres.

The drugs which are supposed to be particularly useful as stimulants to the nervous centres are phosphorus and nux vomica. They may be combined in the following manner, as suggested by Gross:—

℞ Quiniæ sulphatis,	
Ferri sulphatis	of each gr. xl.
Zinci phosphidi	gr. ij.
Acidi arsenosi	gr. iss.
Strychniæ sulphatis	gr. $^2/_3$.

M. et ft. pil. No. xl.
Sig.: Two pills every eight hours.

Damiana and cantharides have gained some reputation among the laity as aphrodisiacs, but damiana has little or no effect, and cantharides acts as an irritant upon the kidneys and bladder whenever taken in doses sufficiently large to act as a genital excitant.

It was hoped that, when the animal extracts were first introduced, they might prove of value, but extended trials of them have only resulted in disappointment.

Electricity enjoys a high reputation in the treatment of atonic impotence. The constant current is adapted to most cases, beginning with the positive pole applied over the lumbar region and the negative pole used to stroke the penis, testicles, and perineum. The strength of the current may be gauged by the sensitiveness of the patient, and it should not be used strong enough to cause discomfort. The sittings at first should be for two or three minutes every forty-eight hours, and soon increased to five minutes daily. In obstinate cases, if erections do not occur from these applications, the positive electrode may be introduced into the rectum and a more powerful effect excited. In cases where marked anæsthesia of the skin of the genitals exists, the faradic current may be used, with better results than the galvanic.

Cold douches or the alternate use of cold- and hot- water douches, applied with some force to the spine daily, are of some assistance, and in the same way irrigation of the rectum with hot water through a Kemp tube may be of some service as a local stimulant to the prostatic urethra.

Local treatment of the urethra is, of course, demanded when atonic impotence is complicated by chronic inflammation of the posterior urethra (see "Symptomatic Impotence"); but, in cases where the posterior urethra is healthy and the difficulty is a pure neurosis, the passage of sounds and use of instillations generally increase the neurasthenia, and the patient is made worse.

The operation of ligation of the dorsal vein of the penis has been practiced, with the object of retarding the return-flow of blood, and so allowing the erectile tissue of the corpora cavernosa to become distended and filled up with blood, in the cases where a partial erection occurred, but where the penis almost immediately became flaccid without any discharge of semen. A few cases have been reported where this operation proved successful, but the mental effect of an operation may have been partly responsible for the good result.

After the condition of impotence has yielded to protracted and careful treatment, and the patient is again able to have erections and ejaculate normally, he should be warned against indulging too freely in sexual intercourse, for any excess in this line will be very apt to be followed by a recurrence of his former disability.

SYMPTOMATIC IMPOTENCE.

This is by far the most frequent type of impotence met with in practice. The disability is never primary, as in the other forms, but it is always dependent upon and secondary to certain structural pathological changes, located in the nervous system or the urethra and its adnexa, and the inability to copulate is only one symptom of many which go to make up the clinical picture.

In symptomatic impotence erections may be completely absent, although, as the genital centres in the nervous system are not affected, sexual desire is usually present.

In many cases a partial erection of the penis takes place, and the seminal fluid is ejaculated prematurely. This form is generally spoken of as

VARIETY A. IRRITABLE IMPOTENCE.

This term is derived from the fact that, on account of the irritable state of the posterior urethra, the ejaculation of semen occurs prematurely before the penis has penetrated into the vagina, and the organ, which never attained to a complete erection, becomes flaccid immediately after the discharge. Many of these cases, which are characterized at first by premature ejaculation, grow worse, and in time the power of erection disappears entirely.

Irritable impotence generally depends upon the presence of chronic posterior urethritis, and the inflammation often extends from the urethra through the ejaculatory ducts, and the prostate and seminal vesicles become affected also.

Chronic posterior urethritis originates from a gonorrhœa or from sexual excesses, masturbation, or the pernicious habit of interrupted coitus, or "withdrawal."

These causes are liablé to induce a condition of chronic engorgement of the blood-vessels in the posterior urethra, and, in course of time, hyperplasia of the submucous connective tissue occurs, and the newly-formed scar-tissue, pressing upon the delicate nervous structures of the verumontanum, occasions various reflex symptoms in the brain, nervous, and muscular systems. The process is often further complicated by germ-infection, often the bacillus coli, which aggravates the existing conditions.

Instead of a chronic posterior urethritis being responsible for the reflex disturbances, an organized stricture may be present in the pendulous urethra, and, if the stricture be located in the deeper portion of the canal, it interferes so much with the circulation of blood, in the posterior urethra, that a chronic congestion results, which disappears promptly when the stricture is treated.

TREATMENT.

To treat the symptom of irritable impotence successfully, the condition in the posterior urethra requires attention. (See "Chronic Posterior Urethritis," "Prostatitis," and "Seminal Vesiculitis.") The discharge of pus, if present, should be controlled by irrigations, and later, when shreds alone are found floating in clear urine, instillations of nitrate of silver in the posterior urethra are called for.

The submucous infiltration can be favorably influenced by the passage of large-sized sounds. An instrument of particular efficacy in reducing the irritability of the posterior urethra is the *psychrophor*, which combines the benefits of pressure with the effects of cold in blunting the hypersensitiveness of the nervous system.

If the prostate or vesicles are diseased, massage and expression of their contents, by means of the finger in the rectum, are required to bring about a resolution of those affected organs, and, if a stricture is present, it must receive appropriate treatment, either by dilatation or cutting.

The prognosis of irritable impotence is good in so far as we can succeed in removing the cause upon which the impotence depends.

VARIETY B. PARALYTIC IMPOTENCE.

In paralytic impotence erections do not take place at any time, although half-erections sometimes occur. Ejaculation does not occur at all, or else takes place without causing any sensation, and the semen is not ejected in jets, but gradually oozes from the meatus.

On examination the genitals are found withered and flaccid, and the skin of the penis is but slightly sensitive, often quite anæsthetic. The sensitiveness of the urethra is diminished, and a sound may be passed with ease and without pain.

Paralytic impotence, as its name implies, is dependent upon organic cerebral or spinal disease, which causes paralysis in other parts of the body. Blows upon the back of the head are especially liable to be followed by complete impotence.

In locomotor ataxia in the early stages, there may be a condition of priapism; but, as the case progresses, the sexual powers decline, until finally the patient may be completely impotent. Myelitis in mild forms does not affect the sexual powers, but in severe forms a state of impotence is induced.

The prognosis in paralytic impotence is, of course, bad, and treatment, either local or general, is of little or no use.

VARIETY C. IMPOTENCE RESULTING FROM DRUGS.

Sexual power is sometimes diminished or entirely destroyed from the excessive use of certain drugs. Individuals who are addicted to the habitual and excessive use of opium, chloral, bromide of potash, and hashish are very apt, in time, to lose sexual inclination and power to copulate. Workmen who are exposed to the exhalations of certain chemicals—such as arsenic, antimony, and lead—are affected in the same way.

The influence of an excessive quantity of alcohol in reducing sexual power is a matter of common knowledge, but we are not so certain as to the effects of tobacco, although some authorities claim that tobacco has an effect in lessening both sexual inclination and capacity.

An excess of sugar in the blood, which occurs in diabetes, also causes impotence, although the individual's health and strength are apparently not deteriorated.

The **treatment** of impotence resulting from the use of drugs consists, of course, in removing the cause, and, when this can be done, the prognosis is, in general, favorable.

STERILITY.

Until recent years a condition of sterility was always thought to be due to some pathological condition on the part of the woman which prevented conception. It is now recognized that in a small number of cases, although the man is capable of performing the sexual act, still his semen is destitute of the fecundating element, and he is sterile.

As an example of this state may be cited the case of men who have been castrated. After this operation the subjects do not become impotent at once, but, for a year or two after the testicles have been removed, are able to practice copulation and ejaculate a material composed of urethral mucus and secretions from Cowper's and the prostate glands, but devoid of spermatozoa, and hence incapable of impregnating the female.

The composition of normal semen, after ejaculation, is found to consist of spermatozoa formed in the testicles and the secretions of the seminal vesicles, prostate, Cowper's glands, and the glands of the urethral mucous membrane, viz.: Morgagni's crypts and Littré's glands.

The usual quantity of semen ejaculated at one discharge is from ʒii-iv; but, if coitus is repeated frequently, the quantity becomes smaller each time, until finally only a few drops are produced with difficulty.

The essential life-giving element in semen is, of course, the spermatozoa, and the function of the other ingredients is probably to coat the urethral mucous membrane and dilute the semen.

On microscopic examination the spermatozoa present a most striking picture, showing numerous, small, tadpole-shaped bodies moving actively in the field. They continue to show movements until at least twelve hours after evacuation, and will present signs of activity for forty-eight hours if sheltered from light and cold.

The semen also contains *spermatic cells,* which are supposed to be breeding-places for the spermatozoa, one of which, according to Kölliker, develops out of each nucleus of a cell. *Böttcher's* crystals are discovered on adding a few drops of 1-per-cent. solution of phosphate of ammonia, and appear as variegated groups of dagger-shaped crystals. It is supposed that the organic base of the crystals exists in the secretion of the prostatic follicles, and gives the semen its characteristic odor.

Finger classifies the pathological changes in the semen which cause sterility as follows:—

I. Azoöspermia, or absence of spermatozoa.

II. Oligozoöspermia, or a marked diminution in the number of spermatozoa.

III. Necrospermia: The spermatozoa are dead and without motion.

IV. Aspermia, entire absence of semen: 1. Absolute. 2. Temporary.

I. AZOÖSPERMIA.

In this condition there is an entire absence of spermatozoa. The physical character of the semen is not distinguishable from normal; the odor, consistence, and color are unchanged; and the absence of spermatozoa can only be detected by the microscope.

Azoöspermia is, of course, the normal condition before puberty, but it is rarely found in old men, who usually are able to form a few spermatozoa.

The pathological causes which bring about this condition may be grouped as follows:—

(a) **Frequent seminal emissions**, either from excessive masturbation or too frequent coitus, cause, first, a diminution in number, and, if persisted in, a complete disappearance of spermatozoa, which reappear in the semen again after a few days' rest.

(b) **Disturbance of the Secreting Function of the Testicle.**—This generally occurs in the acute fevers, and the debility following convalescence, and, as a result, the spermatozoa disappear temporarily from the semen. In chronic diseases the same often occurs, and azoöspermia often exists in tuberculosis and in syphilis, even when the testicles are not affected.

(c) **Disease of the testicle**, caused by syphilis, tuberculosis, or malignant disease, if it is bilateral and destroys completely the parenchyma of the organ, interferes with the formation of spermatozoa and leads to sterility. It is necessary, however, that it should be a complete destruction, for, if a small part of the secreting portion is left, spermatozoa may still be formed.

(d) **Absence of both testicles**—either from removal by castration, atrophy consecutive to orchitis, congenital absence, or atrophy following ectopia testis—will, of course, induce permanent and irremediable sterility.

(e) **Bilateral obstruction of the vas deferens** is the commonest cause of azoöspermia, and results from epididymitis, which in 90 per cent. of the cases is due to gonorrhœa. Tuberculosis and syphilis are responsible for the remaining 10 per cent. The obliteration of the vas deferens is caused by the pressure, upon the seminiferous tubes, of a mass of inflammatory scar-tissue in the tail of the epididymis, which contracts, and squeezes the tubes together. Finger cites 242 cases of double epididymitis, out of which 207 suffered from azoöspermia.

The treatment of azoöspermia seldom meets with much success, except in cases of syphilitic epididymitis. Here an energetic course of antisyphilitic medication will often cause absorption of the infiltration, and the testicle resumes its function.

In gonorrhœal epididymitis the infiltration is hard and dense, and after it has existed some little time it is impossible to bring about its absorption. It is important, for this reason, to treat every case of gonorrhœal epididymitis carefully, in order to avoid the danger of sterility (see "Epididymitis").

II. OLIGOZOÖSPERMIA.

This condition consists in a marked diminution of the number of the spermatozoa, and may, in general, be regarded as a temporary condition, which, depending upon its cause, either returns to the normal state or goes over into complete absence of spermatozoa (azoöspermia).

Oligozoöspermia occurs normally in old age and at the beginning of puberty, and it also occurs in general debility from any disease and also after repeated acts of sexual intercourse. The most usual causes for it are gonorrhœal epididymitis or new growths—either syphilis, tuberculosis, or cancer—which involve the epididymis.

As long as the vasa deferentia are not completely closed by the inflammation, a few spermatozoa may make their way through the canal. If the spermatozoa are diminished in number, and at the same time motionless, sterility is assured; but, if the spermatozoa retain their movement, there is always procreative power left, but in a lessened degree.

III. NECROSPERMIA.

In this condition the male is able to copulate and to ejaculate semen, but on microscopic examination the spermatozoa are found to be dead and without motion. In order to make a valid test, it is necessary to examine the semen not later than one to two hours after ejaculation, and the specimens can only be secured by directing the man to have coitus while wearing a condom.

Necrospermia is brought about by a variety of causes which diminish the secreting capacity of the testicle. Excesses in venery or unduly frequent seminal emissions operate in this way. At first the semen is normal, but in time it becomes thinner, the numbers and motility of the spermatozoa diminish, and they become small, deformed, and unripe.

The same effect is produced upon the spermatozoa by a disturbance in the nutrition of the testicle from alcoholism, morphinism, general tuberculosis, or diabetes. Various local processes—such as syphilis, carcinoma, and beginning atrophy—exert their effect upon the parenchyma of the gland, and the formation of spermatozoa is affected in consequence.

A more frequent cause of the death of the spermatozoa is some pathological alteration of the component parts of the semen. Inflammation of the seminal vesicles, either acute or chronic, causes perceptible alteration in the semen. It is usually purulent and sometimes bloody, deriving its foreign constituents from the inflamed cavities of the vesicles, and the spermatozoa are found to be dead.

The spermatozoa are also motionless in cases of chronic follicular prostatitis, for, as Fürbringer has demonstrated, the spermatozoa, so long as they are retained in the seminal vesicles, are motionless, and it requires the contact of the prostatic secretion to arouse their normal motility. When the prostatic follicles are diseased, their secretion is checked, and the spermatozoa are deprived of the stimulant necessary to excite their activity.

As already indicated, the treatment of necrospermia will depend upon the cause which occasions it, and the prognosis is good or otherwise as we are able to remove its origin.

IV. ASPERMIA.

Aspermia may be defined as a condition in which the male is able to perform coitus properly, but no semen is ejaculated into the vagina of the female, either because none is secreted or because some obstruction in the urethra prevents its passing from the meatus.

Aspermia may be either absolute or temporary, congenital or acquired.

Congenital aspermia is a very rare condition, but a few cases have been reported. Ultzmann assumed it to be due to a non-excitability of the reflex centre of ejaculation. Jacobson suggests that, while the testicles are present and capable of forming spermatozoa, they cannot make their way into the urethra on account of an occlusion of the ejaculatory ducts or an absence, from anomaly of development, of a portion of the vas deferens.

Acquired aspermia is not uncommon and is often the result of suppurative affections of the prostate brought about by gonorrhœa or tuberculosis. Through the destruction of the gland and the subsequent formation of scar-tissue, the ejaculatory ducts are closed by the contraction of the cicatrix. If one duct is left open, the semen is diminished in quantity, but not noticeably so; but, if both ducts are closed, aspermia follows.

The ejaculatory ducts are also occasionally destroyed, during a lateral lithotomy, either by being cut in incising the posterior urethra or by suffering laceration in dragging a large stone out of the bladder and through the wound.

The ejaculatory ducts sometimes become plugged by the formation of concretions composed of spermatozoa, mucus, epithelial cells, and lime-salts.

An insensitive condition of the glans penis may be responsible for the failure of ejaculation, and cases have been reported where an injury to the spine caused a complete anæsthesia of the skin of the genitals. In another case on record the prepuce and dorsum of the penis had been destroyed by ulceration and converted into a large indurated scar, which was entirely insensitive.

One of the most frequent causes of aspermia is stricture of the urethra. On account of the swollen and turgid condition of the mucous membrane of the urethra during coitus, the orifice of a tight stricture is closed, and the seminal fluid is unable to escape past it, but is retained in the urethra behind the stricture. After the congestion subsides the verumontanum no longer closes the vesical outlet, and the semen regurgitates into the bladder, and is subsequently discharged with the urine.

Temporary aspermia is a rare condition which occurs in persons of a nervous temperament who become neurasthenic from excesses in venery, masturbation, or gonorrhœa. Such individuals are usually impotent (psychical impotence), but occasionally such patients are found who can copulate, but cannot ejaculate any semen at the time, although the seminal fluid may escape a few hours later during sleep, as an emission. This form of aspermia begins suddenly, lasts a few weeks or months, and then vanishes as suddenly as it came.

The treatment of aspermia in its various forms depends upon the etiology, but the variety depending upon stricture offers a good prognosis when the urethra is restored to its normal calibre.

LIST OF GENITO-URINARY INSTRUMENTS REQUIRED FOR OFFICE USE.

VALENTINE'S irrigator.

Ultzmann's syringe.

Large hard-rubber or glass syringe. Capacity, 4 to 6 ounces.

Oberlaender or Kollmann's dilator, antero-posteror.

Otis urethrometer.

Eighteen steel sounds, Van Buren curve. Numbers 16 to 34 French, inclusive, but omitting every other number.

Benique sounds, 16 to 34 inclusive, omitting every other number.

Tunneled sounds, numbers 12, 14, 16, 18, and 20 French.

Psychrophor with Benique curve; attached to four-quart douche-bag.

Bougies a boule, metal; numbers 16 to 32 inclusive, omitting every other number.

Guyon's flexible gum-elastic bougies a boule, 16 to 30 French, omitting every other number.

One dozen whale-bone guides.

Thompson's searcher for stone.

Nitze's observation cystoscope.

Six Klotz endoscopes (Eissner & Co., New York): 3 four inches long. Calibre, respectively, 26, 28, and 30 French. One five and one-half inches long. Number 26 French. Two six inches long. Numbers 28 and 30 French.

Head-mirror.

Oil-lamp (Belgian or other circular wick, with central draft).

Long urethral forceps.

Hypodermic syringe for injecting mercurial salts (Eissner & Co., New York).

Catheters: Soft rubber. Silver, with prostatic curve. Mercier coudé and bicoudé (prostatic). One Gouley tunneled silver catheter, English, with stylet.

Flexible bougies from number 18 down to smallest.

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